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Accelerating the decarbonization of the Chemical Industry

Keys to defining a roadmap for the sector

October 2026



alinnea has been an active actor in the climate action ecosystem in Spain since mid-2024. It is part of IE University and is supported by the European Climate Foundation. **alinnea** is an entity specialising in comparative analysis and the search for solutions in the articulation of climate action measures that involve different sectors from both the public and private spheres, as well as the social fabric.

Under a multi-actor dialogue-research-action framework, it seeks to provide solutions to barriers to the advancement of climate action, in a way that is socially just, economically prosperous and positive for the environment and the protection of biodiversity.

Between March and July 2026, **alinnea** conducted four working sessions with fifty strategic actors —from the public and private sector, multilateral organizations, the social sector and academia— with the aim of accelerating the decarbonization of the chemical industry in Spain. This process made it possible to gather critical analyses and highly relevant practical experiences. This report, based on that dialogue, offers a detailed analysis of the main challenges facing the chemical industry in Spain in terms of ecological transition, and identifies priority measures to advance its decarbonization.

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01 Executive Summary

The chemical industry is a strategic part of the Spanish economy due to its contribution to industrial activity, employment, exports and innovation, as well as its role as a supplier for 98% of the productive sectors. In 2025 it achieved a turnover of **€85,417 million**, generated more than one million direct, indirect and induced jobs and allocated **€2,262 million to R&D&I** activities. Its transformation is essential to reduce emissions and environmental impacts of its own processes, but also to provide the materials and solutions that other value chains need to advance their decarbonization.

The diagnosis prepared by the Working Group shows that this transition is conditioned by a set of interdependent bottlenecks. High energy costs, dependence on gas, and limitations in networks and infrastructure hinder electrification and the use of alternative sources. Added to this are regulatory complexity and instability, administrative delays, high investment needs, a lack of adapted financial instruments, and still insufficient demand for low-carbon and circular products. International competitive pressure, external dependencies, shortcomings in measurement and traceability, and the need to adequately incorporate territorial, labor, environmental, and health dimensions complete a scenario that cannot be addressed through isolated actions.

Furthermore, there is no single technological solution for the entire sector. Different chemical activities exhibit different levels of energy intensity, commercial exposure, and technological maturity. Its decarbonization will require combining energy efficiency, electrification, renewable hydrogen, thermal storage, carbon capture, utilization and storage, chemical recycling, alternative raw materials and digitalization. Circularity should be integrated from the design of products and processes, favoring prevention, reuse, resource recovery and the effective reincorporation of secondary raw materials.

To organize this process, the report proposes a roadmap structured in three time horizons. The short term, from zero to two years, is aimed at unlocking investments by reducing energy costs, strengthening networks, streamlining permits, ensuring regulatory stability, improving financing and developing harmonized measurement and control

systems. The medium term, from three to five years, seeks to scale up technologies, infrastructures and lead markets. Beyond five years, the goal is to consolidate a climate-neutral, circular industrial model supported by an energy system fully integrated with production needs. The actions are organized into four areas: enabling conditions; technologies and decarbonization; demand and market; and competitiveness and strategic autonomy.

Based on this, the report develops three priority recommendations. The first proposes **to promote Green Public Procurement as an instrument for creating demand**, taking advantage of the new Green Public Procurement Plan 2026-2033 to identify priority categories, establish common environmental criteria, aggregate and anticipate purchases and connect the financing of new productive capacities with the existence of markets for their products.

The second proposes **to strengthen the joint effectiveness of the EU ETS and the CBAM**. To achieve this, it is proposed to maintain a predictable carbon signal, to align the phase-out of free allocation with the CBAM's actual capacity to prevent carbon leakage, to progressively extend protection to exposed products and value chains, and to link transitional mechanisms and generated revenues to verifiable decarbonization investments.

The third recommendation aims to **strengthen market surveillance and customs controls** to ensure that imported products meet the same obligations as those manufactured in the European Union. This requires strengthening human, technological and laboratory resources, improving coordination between authorities, developing risk-based controls and using interoperable information, certification and traceability systems.

Overall, the transformation of the chemical industry requires an integrated strategy that coordinates climate, energy, industrial, trade, and financial policies. Its success will depend on the effective reduction of emissions and environmental impacts progressing alongside investment, the preservation of employment and productive capacities, the strengthening of value chains, and adequate participation of the affected territories and actors.



02 Introduction

This report summarizes the main conclusions of the Working Group on the Decarbonization of the Chemical Industry in Spain, promoted by **alinnea** with the aim of identifying the main obstacles that condition the transformation of the sector and formulating recommendations that allow progress in its decarbonization, while strengthening its competitiveness and resilience. This initiative continues the Industrial Decarbonization Working Group that began in 2025.

The chemical industry occupies a strategic position in the Spanish and European economy. In addition to its weight in terms of activity, employment, exports and innovation, it acts as an essential supplier of materials, products and solutions for virtually all productive sectors. Its transformation is therefore essential to achieve climate goals, but also to facilitate the decarbonization of other value chains, strengthen strategic autonomy and preserve European industrial capacity.

Despite regulatory advances and support instruments developed in recent years, the transformation of the sector continues to face energy, technological, regulatory, financial and market barriers. High energy costs, limitations in networks and infrastructure, administrative complexity, insufficient demand for low-carbon and circular products, difficulties in accessing financing, and exposure to international competition affect the viability of investments. Added to this are the challenges associated with supply chains, the availability of raw materials, the measurement and traceability of products, and the scaling up of new technologies and circular processes. Overcoming these obstacles requires a shared vision among public administrations, industry, financial actors, unions, civil society and academia.

To this end, **alinnea** promoted a multi-stakeholder dialogue process under the Chatham House Rule, structured in three working sessions held between March and May 2026 and an additional meeting in July to jointly review the content of the recommendations. They included representatives from the public and private sectors, industrial associations, financial institutions, unions, social organizations, technology centres, academia, and experts. The sessions addressed pathways for the decarbonization of the chemical industry, the role of energy and technology as enabling conditions, and the contribution of finance, the aid framework, and trade to its transformation. The process also incorporated the regulatory, geopolitical, territorial, and social dimensions of this transition.

Despite regulatory advances and support instruments developed in recent years, the transformation of the sector continues to face energy, technological, regulatory, financial and market barriers.

The conclusions are included in the sections on diagnosis, key issues, roadmap and recommendations for action that make up this report. Its objective is to contribute to a long-term strategy for the Spanish chemical industry, aligned with the EU Chemicals Industry Action Plan, which combines the deployment of decarbonization and circularity technologies with appropriate economic and regulatory conditions, increased demand for sustainable products, and the strengthening of competitiveness and strategic autonomy.

We would like to especially thank all the people and organizations that have participated in this working group for sharing their knowledge, experience and time, the experts who contributed with their presentations and reflections, and Florent Marcellesi for his technical support during the process.

The findings, analyses, and conclusions presented in this report are based on available information, obtained from primary sources or other research cited in the document and considered accurate and reliable. The collaborating individuals and institutions are not responsible for the interpretation of this information or for any losses that may result from decisions of any kind made based on it. Likewise, acknowledgment or gratitude to an organization does not imply its endorsement of the final text.

2.1 Objectives

This document aims to develop a shared diagnosis on the decarbonization of the chemical industry in Spain, determine the main obstacles that condition this process and formulate recommendations for action that will accelerate its transformation without compromising its competitiveness, resilience and productive capacity.

The sector's transition must respond to a dual challenge. On the one hand, it requires reducing emissions and the environmental impacts associated with its processes, making progress in replacing fossil fuels and conventional raw materials, and incorporating more efficient and circular technologies and production models. On the other hand, it must preserve a strategic activity that supplies essential materials, products and solutions to the economy as a whole and that can contribute to the decarbonization of numerous value chains.

Spain has a productive, exporting and innovative chemical industry, but the magnitude of the necessary investments requires creating suitable conditions for their implementation. Its realization will depend on the availability of competitive energy, sufficient networks and infrastructure, a stable regulatory framework, adapted financing instruments, and markets capable of recognizing the value of low-carbon and circular products. It will also be necessary to limit the risks of loss of competitiveness, carbon leakage, and increased external dependencies.

Based on the analysis carried out and the dialogue between the different actors, the report seeks to define the priority elements of a national roadmap aligned with the European Union Action Plan for the chemical industry. With this, it aims to facilitate decision-making, strengthen coordination between public administrations, industry, the financial sector, trade unions, civil society and academia, and lay the foundations for a long-term strategy that combines circularity, competitiveness and strategic autonomy.

2.2 Methodology

The methodology used to prepare this report consisted of holding a series of working sessions in face-to-face and hybrid formats. Following the multi-stakeholder dialogue format under the Chatham House Rule, the work was geared towards identifying priority measures to advance the decarbonization of the chemical industry in Spain. This process made it possible to design a set of recommendations aimed at boosting this decarbonization process.

This work has involved the participation of a diverse group of strategic actors from the public and private sectors, the social sector and academia, who have participated in three working sessions between March and May 2026.

- **Session 1.** Pathways to decarbonizing the chemical industry: Challenges and opportunities
- **Session 2.** Energy and technology as enabling conditions for transformation
- **Session 3.** Financing, the aid framework and trade as levers for transformation

In **July 2026** an additional meeting was held to jointly review the content of the report.

Throughout these sessions, the following presentations were given; we thank the speakers for their time and work:

- **Decarbonization of the chemical industry: Diagnosis of the sector in terms of emissions and key aspects of decarbonization. Florent Marcellesi, Collaborator, alinnea**

- **The chemical industry in the new geopolitics of energy and supply chains. Sergio Soler, Collaborator, alinnea**

- **EU Chemicals Industry Action Plan and the Critical Chemicals Alliance. Algreit Dume**, Policy Officer, DG GROW (online)

- **Proposed roadmap for climate neutrality in the Spanish chemical industry. Cristina González**, Director of Strategy, Advocacy and Competitiveness, FEIQUE

- **Vision of the technological context of the decarbonization of the chemical industry. Elisa García**, Chemical Differentiation and Circularity Manager and **Lucía Carretero**, Chemical Differentiation and Circularity Technician, Repsol; **María González**, Head of Environment and Energy Transition, Moeve Química; **Eva Verdejo**, Head of the Recycling and Biotechnology Cluster, AIMPLAS; **Iván Albertos**, Head of Public Affairs, Sustainability and Regulation, BASF; **Gonzalo Fernández**, Director of Projects and Technology, Fertiberia Group; **Carlos Sánchez**, Engineering Director, Bayer Hispania; **Carlos Sanz**, Chief Operations Officer, Matteco; **Samuel Pérez**, Head of Electrification and Demand Technologies, Iberdrola; **Marta Cartón**, Industry and Equipment Project Manager, UNE.

- **Proposal for an Affordable Electricity Plan for Spanish Industry. Carlos Reinoso**, Spokesperson, Alliance for the Competitiveness of Spanish Industry.

- **Measures for the decarbonization of the chemical industry from an environmental perspective. Susana Millán, Head of Communication and Social Mobilisation, Industrial Transformation Campaign**, Ecologistas en Acción

- **The financing framework and state aid for the chemical industry. Sancho Ubani**, Decarbonization Reference Manager at Zabala Innovation



03 Strategic weight and role of the chemical industry

The chemical industry occupies a central position within the national and European production structure. Its importance derives not only from its direct economic weight, but also from the role it plays as a basic supplier of materials, components and solutions for practically the entire industrial fabric. Unlike other sectors that are more easily identifiable by their final product, **the chemical industry acts as a cross-cutting productive infrastructure**. At the European level, the European Commission (2023) points out that chemicals are present in most manufactured goods and are at the base of large industrial value chains. Meanwhile, in Spain the sector acts as an essential supplier of products and technologies for 98% of the productive sectors, according to FEIQUE (2026).

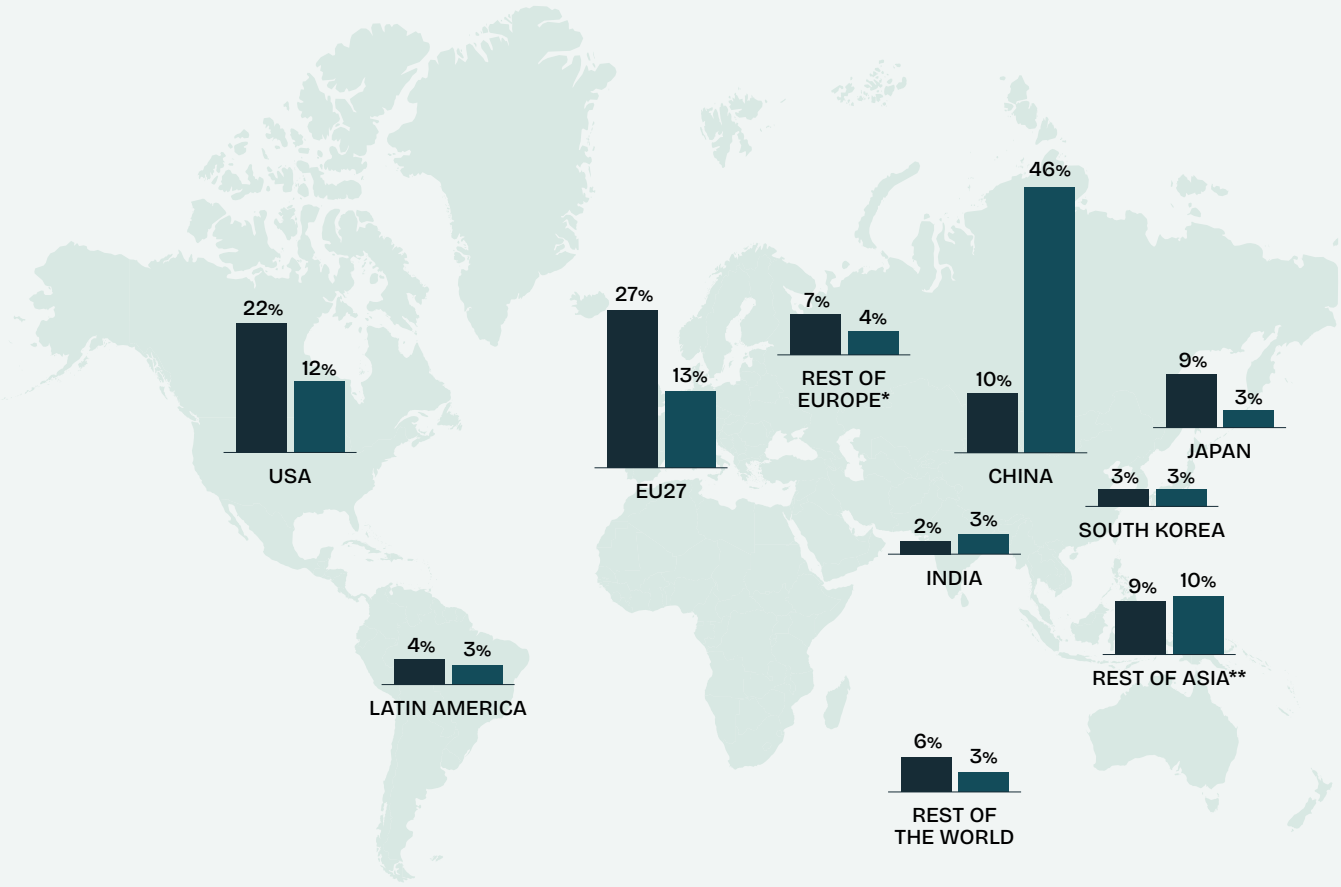
In the European context, the chemical industry continues to be one of the main pillars of the Union's economy, both because of its volume of activity and its presence in industrial employment, as well as its ability to generate high value-added products (Cefic, 2025). According to Cefic (2025), the European chemical sector reached a turnover of €635 billion in 2024 and employed 1.2 million people, according to the latest available data, which confirms its relevance within the European industrial base. Although Europe has lost relative weight in the global chemical market, with a share in 2024 of around 13% compared to China's 46% (Cefic, 2025), the sector retains strategic relevance due to its integration into complex value chains and its role in European industrial resilience (DG GROW, 2023). This position, however, coexists with increasing competitive pressure, associated with energy costs and weak regional demand (Deloitte, 2025). This is compounded by a context of global overcapacity, driven by successive additions of new petrochemical capacity since 2020, especially in China, in a scenario of lower growth in chemical demand and deterioration of utilization rates on a global scale (ICIS, 2024).

Within this European context, the Spanish chemical industry remains one of the pillars of the national manufacturing fabric. According to the Snapshot

Figure 1. Global distribution of chemical sales

China overtakes Europe and the US as global leader in chemical sales

Evolution of chemicals sales (2004 vs 2024)



Source: Cefic.

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

**Asia excluding China, India, Japan and South Korea

of the Spanish Chemical Sector 2026[1] prepared by FEIQUE, in 2025 the sector reached a turnover of €85,417 million and exports of €62,926 million, equivalent to 73.7% of its sales, which placed it as the main exporting sector of the Spanish economy. It also generated 226,450 direct jobs and a total of 1,030,348 jobs when incorporating indirect and induced effects. Its relevance is also reflected in a contribution in 2024 of close to 4% of the Spanish GDP and in its leadership in innovation, with an investment and expenditure in R&D&I of €2,262 million, equivalent to 23.5% of the industrial total. These figures help us understand why the chemical industry cannot be analyzed simply as another

[1] Figures corresponding to NACE 20 and 21.

The chemical industry is one of the sectors undergoing profound transformation, but it also provides materials and technologies necessary to move towards a more sustainable economy.

industrial branch, but as a strategic sector whose evolution conditions the competitiveness, innovative capacity and technological development of the entire Spanish economy (FEIQUE, 2026).

The systemic function of the sector is also observed in its relationship with the ecological transition. The chemical industry is one of the sectors undergoing profound transformation, but it also provides materials and technologies necessary to move towards a more sustainable economy. The chemical industry provides relevant materials and inputs for the energy transition and can facilitate the decarbonization of other production systems, if it also transforms its own processes and raw materials (RMI, 2025; Systemiq, 2022). Therefore, the European industrial transition cannot be considered apart from this sector, since a large part of the solutions needed to transform other productive activities depend on chemical innovation.

This strategic position requires that the transition of the chemical sector be approached with a certain balance and even caution. The chemical industry must transform its processes, reduce emissions and environmental impacts, and adapt to an increasingly demanding regulatory framework. However, this transformation cannot result in a loss of industrial capacity. A weakening of the sector could increase dependence on foreign raw materials, intermediate products and essential inputs, and reduce Europe's capacity to develop its own technologies. This risk takes on special relevance in a context of changing orientation of European industrial policy, which is giving increasing weight to production in Europe, strategic autonomy and the protection of industrial capabilities considered essential. Therefore, the challenge is not to replace the chemical industry, but to decarbonize and modernize it, while maintaining productive capacity and, therefore, technological autonomy (DG GROW, 2023; industriAll Europe, 2025).

The European and Spanish chemical industry is an activity exposed to significant challenges, but it also constitutes an essential basis for any reindustrialization and sustainable transition strategy. Its cross-cutting nature makes it a particularly sensitive sector: difficulties affecting the chemical industry are transferred to the rest of the economy, while its advances can accelerate the transformation of numerous value chains. For all these reasons, in recent years a major policy effort has been made to adapt the regulatory framework of the sector.

3.1 Regulatory context

3.1.1 European framework

In recent years, the European Union has been promoting an agenda that combines the achievement of climate and environmental protection objectives with the pursuit of industrial competitiveness and strategic autonomy.

1. Strategic orientation of the industrial transition

European Green Deal

The European Green Deal, approved in 2019, laid the first major stone by placing climate neutrality at the heart of European political action. The European Commission presented it as a roadmap to transform the Union's economy, reduce environmental pressure and decouple growth from intensive resource use. For the chemical industry, this framework is of particular importance because it is an energy-intensive sector, dependent on fossil raw materials and located at the origin of numerous industrial value chains.



Clean Industrial Deal

The Clean Industrial Deal introduces an updated approach within the European transition policy. In contrast to a reading focused more on emissions reduction, this pact proposes that decarbonization must be accompanied by an **industrial strategy capable of sustaining production, investment and quality employment within the European Union.**

The Commission starts from the premise that industrial sectors cannot be transformed solely through environmental obligations, but rather need conditions that make that transformation viable, such as:

- Clean energy at competitive prices.
- Less regulatory complexity.
- Protection against situations of unequal international competition.

In this sense, the Clean Industrial Deal acts as a bridge between the climate ambition of the European Green Deal and the need to preserve strategic production capacities in Europe. Its logic is not to abandon environmental goals, but to make them achievable without causing deindustrialization. This new environmental impetus must serve as a lever for a new reindustrialization of Europe.

Competitiveness Compass

This approach falls within the framework of the EU Competitiveness Compass, which sets out the main guidelines for EU economic and industrial policy for the 2024–2029 legislative term. The document addresses issues such as:

- The need to close the innovation gap.
- Ensuring compatibility between decarbonization and competitiveness.
- Reducing strategic dependencies.

To achieve this, it considers instruments such as affordable energy, administrative simplification, and the strengthening of productive investment.

European Action Plan for the Chemical Industry

More specifically for the sector, the European Action Plan for the Chemical Industry, presented in 2025, reflects the intention to address the transformation of this industry from its own sectoral logic. Its great value lies in the fact that it recognizes that chemistry is not only a sector subject to increasing environmental demands, but a **strategic activity for the resilience of the European industrial base.**

The Plan is structured around four main pillars:

1. **Resilience: strengthening the resilience** of the European chemical industry.
2. **Energy, decarbonization and circularity:** ensuring a competitive energy supply and supporting decarbonization and circularity.
3. **Markets and innovation: creating lead markets for clean chemicals and driving innovation.**
4. **Regulatory simplification: simplifying the regulatory framework** applicable to the sector.

In the area of energy, the Action Plan sets out this objective through measures aimed at **reducing the cost differential borne by the European chemical industry compared to competitors such as the United States or China.** These include:

- The review of the ETS indirect cost compensation guidelines with a view to extending coverage to additional chemicals.
- Improving access to electricity networks.
- Accelerating the permits and connections needed for electrification projects.

The Plan also refers to the implementation of the Affordable Energy Action Plan, promotes the use of long-term energy contracts and contemplates support for low-carbon hydrogen, along with the development of shared energy infrastructures in the main European chemical hubs.

Therefore, the Plan integrates into a single agenda the main tensions facing the sector, connecting the pressure of energy costs and global competition with the environmental and industrial transformation of European chemistry. In this sense, the Plan positions the transition of the chemical sector as a central element of European industrial policy and not just as a simple sectoral derivative of climate or environmental policy. As the Commission itself pointed out, this plan, the third of a sectoral nature, aligns with the strategic commitment to strengthen European competitiveness and the industrial base, embodied in the aforementioned Clean Industrial Deal.



2. Infrastructure, strategic autonomy and productive capacities

European Grids Package

The modernisation of the energy system is completed with the European Grids Package, aimed at accelerating the expansion of electrical infrastructure, improving its planning and facilitating the connection of new projects. The initiative seeks to reduce delays in accessing the grid, anticipate the needs arising from electrification, and strengthen interconnections and capacities available in the main industrial sites.

Critical Chemicals Alliance

Following this same logic, it is worth mentioning the Critical Chemicals Alliance, of which **alinnea** is a member, conceived as a space for cooperation between European institutions, industry and other relevant actors to identify chemical substances and value chains that are especially critical to the European economy.

Its function is to analyze dependencies, supply vulnerabilities and risks of capacity loss in essential chemicals for strategic sectors. For the chemical industry, this initiative is crucial in linking the sector's transition with the need to preserve European strategic autonomy.

Working Group on Import Surveillance

The Action Plan foresees strengthening the monitoring of chemical imports through the Working Group on Import Surveillance. Its task is to analyze the evolution of trade flows and detect potentially harmful increases in imports early, in order to assess, when necessary, the adoption of measures through European trade defense instruments.

Competitiveness Coordination Instrument

The modernization of certain productive capacities is linked to the Competitiveness Coordination Instrument, designed to better align the actions of the European Union, Member States and regions. In the chemical field, a pilot project is planned focusing on facilities such as **steam crackers and ammonia production plants**, in order to identify common needs for investment, infrastructure and regulatory reform.

This set of plans, strategies and initiatives sets the political direction of the European chemical transition. However, its impact on the sector is realized through a broad regulatory framework, which complements the described political guidelines with legal obligations.

3. Climate goals and emissions control

Industrial Emissions Directive

The Industrial Emissions Directive, approved in 2010 and amended in 2024 by Directive (EU) 2024/1785, is a fundamental standard for chemical installations. This standard establishes an integrated system for the prevention and control of pollution from industrial activities, supported by environmental authorizations and the application of the best available techniques.

The recent revision of this Directive also reinforces the trend towards more integrated regulation of industrial emissions and their environmental impacts, with greater attention to the environmental performance of facilities and the conditions applicable to the most impactful industrial activities.

European Climate Law

The climate dimension of the European framework was legally reinforced by the European Climate Law, approved by Regulation (EU) 2021/1119. This regulation establishes the binding objective of climate neutrality by 2050 and incorporates the intermediate objective of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. In 2026 it was updated to include a binding target of a net reduction of 90% by 2040 compared to 1990.

Horizon	Climate goal
2030	Reduction of net greenhouse gas emissions of **at least 55%** compared to 1990 levels.
2040	Net reduction of emissions of **90 %** compared to 1990, incorporated as a binding target in the 2026 update.
2050	**Climate neutrality,** established as a binding objective.

With this, climate objectives become a mandatory reference for all European policies, including industrial and energy policies. For the chemical industry, this means operating in a context where decarbonization is no longer a voluntary orientation but becomes part of the structural conditions of economic activity in the European Union.

European Emissions Trading System — EU ETS

Also relevant is the European Union Emissions Trading System (EU ETS), which is one of the main climate instruments with direct effects on the chemical industry.

Introducing a carbon price has very important effects: it influences investment decisions and affects the economic viability of low-carbon technologies. For sectors exposed to international competition, the ETS also poses the challenge of preventing increased climate costs from leading to production losses or the displacement of emissions to third countries.

Carbon Border Adjustment Mechanism — CBAM

In addition, the Carbon Border Adjustment Mechanism (CBAM) seeks to limit the risk of carbon leakage and prevent imports of certain products from third countries from circumventing a carbon signal comparable to that borne by European production.

4. Energy, clean technologies and innovation

Energy efficiency and renewable energy directives

- **Energy Efficiency Directive 2023.** It raises European ambition in terms of reducing energy consumption and sets a binding target for reducing the Union's final energy consumption of **11.7% by 2030** compared to the 2020 baseline scenario forecasts, which directly affects energy-intensive industrial sectors.
- **Reform of the Renewable Energy Directive of 2023.** It raises the binding renewables target to **42.5% of gross final energy consumption in 2030,** with aspirations to reach **45%.**

European Gas and Hydrogen Package

On the other hand, the European Gas and Hydrogen Package, approved in 2024 and consisting of a Regulation and a Directive, establishes a common framework for the renewable gas, natural gas and hydrogen markets.

To that end, both regulate:

- Access to networks.
- Infrastructure planning.
- The separation of activities.
- The development of a specific hydrogen market.

The aim is to facilitate the progressive integration of renewable and low-carbon gases into the European energy system.

Net-Zero Industry Act

The Net-Zero Industry Act (2024) introduces a European framework to accelerate the development and deployment of clean technologies considered strategic for the transition. Although it is not a sector-specific standard for the chemical industry, it addresses several of the solutions that may influence its transformation, such as:

- Renewable hydrogen.
- Carbon capture, utilisation and storage (CCUS) technologies.

- Other low-emission industrial technologies.

This is a regulation that complements those that set ambitious climate objectives, by providing the industrial base that allows these objectives to be achieved.

Industrial Accelerator Act

Added to this is the future Industrial Accelerator Act, proposed by the European Commission in March 2026. This initiative is aimed at strengthening the demand for low-carbon technologies and industrial products manufactured in Europe.

The proposal could subsequently facilitate the creation of markets for certain low-carbon or sustainably sourced chemicals, through measures that the Commission would be empowered to develop.



Advanced Materials Act

Among the planned initiatives is also the Advanced Materials Act, intended to promote the development, manufacture and scaling up of materials with strategic applications in the European Union. The future framework aims to improve the coordination of investments and accelerate the arrival on the market of materials intended for various sectoral activities.

European Centres for Chemical Innovation

The Plan also proposes the voluntary creation of European Centres for Chemical Innovation, conceived as spaces for collaboration between companies, public institutions and research entities.

These centers would facilitate the testing, demonstration, and scaling up of emerging processes, including those based on electrochemistry, photochemistry, and other technologies aimed at reducing energy and material consumption in production.

5. Financing and support for industrial investments

Industrial Decarbonization Bank

Furthermore, in July 2026 the European Commission presented a proposal to reform the EU Emissions Trading System (EU ETS) Directive which provides for the creation of an Industrial Decarbonization Bank as a specific instrument to support the transformation of industry.

From **2028,** this entity could channel aid primarily through:

- **Carbon contracts for difference (CCfD).**
- **Carbon premiums.**

Both instruments would be awarded through competitive procedures. The CCfDs would allow compensation, for a **maximum period of ten years**, of the difference between a strike price set in the award and the effective carbon price in the EU ETS, linking the payments to **verified emission reductions**.

State aid rules

Another crucial component of the European framework is the regulation of state aid, especially because the transformation of the chemical industry requires high investments, long amortization horizons and technologies that, in many cases, still have higher operating costs than conventional alternatives.

Therefore, the following frameworks are relevant for converting climate objectives into viable industrial projects:

- The General Block Exemption Regulation (GBER).
- European guidelines on climate, energy and environmental aid.
- The ETS State aid guidelines.
- The Clean Industrial Deal State Aid Framework (CISAF).

Tax incentives

Financial support for the Clean Industrial Deal also includes a Commission recommendation on the use of tax incentives. This approach includes instruments such as **accelerated depreciation and tax credits** to stimulate investments in energy efficiency, electrification, clean technologies and transformation of industrial facilities.

6. Circularity and secondary raw materials markets

Circularity, meanwhile, is playing an increasingly important role in the transformation of the chemical industry.

Regulation on packaging and packaging waste — PPWR

Regulation (EU) 2025/40 on packaging and packaging waste (PPWR), in force since February 2025 and generally applicable from August 2026, strengthens the obligations of:

- Recyclability.
- Waste reduction.
- Recycled content.

In particular, it sets minimum percentages of recycled content in different types of plastic packaging by **2030** and new recyclability requirements.

Regulation on end-of-life vehicles — ELVR

This orientation also extends to the automotive sector through the new End-of-Life Vehicle (ELVR) Regulation, which incorporates **mandatory recycled content targets in the plastics of new vehicles**.

Future Circular Economy Act

These measures will be reinforced by the future Circular Economy Act, planned by the European Commission for 2026, whose purpose is to move towards a more integrated European market for secondary raw materials.

For the chemical industry, this represents a significant change in the way materials and production processes are conceived, as it facilitates the incorporation of recycled resources with greater guarantees of quality, availability and legal certainty.

Ultimately, these initiatives aim to enable circular materials to compete effectively with fossil raw materials and for products derived from them to gain real recognition in the market.

In short, the European framework applicable to the chemical industry shows a clear evolution towards increasingly integrated environmental and industrial regulation. However, the intensity and specific direction of this evolution will depend largely on the configuration of future majorities within the institutions of the European Union and on how these prioritize the different dimensions of the transition.

It will be important to observe, in particular, whether the strengthening of industrial competitiveness and the preservation of European productive capacities end up tipping the balance against environmental demands, or whether both objectives manage to be articulated in a stable equilibrium.

3.1.2 National framework

The Spanish framework aligns with the European one described above. Spanish public action does not occur in isolation, but rather develops or adapts, depending on the nature of the EU legislation, European commitments to the characteristics of the national productive fabric, marked by the presence of a chemical value chain closely linked to other industrial sectors.

1. Energy and climate planning

National Energy and Climate Plan 2023–2030 (NECP, PNIEC in Spanish)

Updated in 2024, the PNIEC is the main planning tool for energy and climate, setting the general framework for action that guides public policies towards a cleaner and more efficient energy model.

For a sector like the chemical industry, especially dependent on energy costs and the availability of

The European framework applicable to the chemical industry shows a clear evolution towards increasingly integrated environmental and industrial regulation.

raw materials, this plan has a profound impact. Its measures focus on:

- The transformation of industrial processes.
- The transition towards a production model less dependent on fossil fuels.
- The incorporation of new technological solutions aimed at decarbonization and greater energy efficiency at plant level.

Long-Term Decarbonization Strategy 2050

Approved in 2020, it offers a broad vision of the transformation of the Spanish economy towards climate neutrality. In the chemical industry, it allows investment and technological change decisions to be placed within a sufficiently broad horizon, in accordance with the complexity of a transition that requires:

- Adapting production processes.
- Renewing infrastructure.
- Phasing out carbon-intensive technologies.

This long-term planning is essential to avoid a disorderly transformation and to guide investments towards solutions compatible with climate objectives.

Electric Power Transmission Network Development Plan 2021-2026

Achieving the objectives set by the PNIEC also depends on the effective development of electrical infrastructure. This plan constitutes the binding instrument through which the actions necessary to reinforce and expand the transmission network are determined.

The 2021-2026 planning, modified in 2024 and 2025, was subject to a third modification approved on **28 July 2026** and published in the BOE on **8 August**, with **51 actions** and an additional investment of €615 million.

This modification is aimed at strengthening the resilience and stability of the electrical system and reducing the use of gas-fired power plants. With it, the total planned investment amounts to €8,818 million.

In parallel, the processing of the planning with a 2030 horizon continues, following the public consultation and the report of the National Markets and Competition Commission (CNMC) of 9 June 2026.

Law 7/2021, on climate change and energy transition

The regulatory framework itself is based on this strategic foundation. Law 7/2021 incorporates into the Spanish legal system objectives for reducing emissions and increasing the use of renewable energies. The NECP (PNIEC), updated in 2024, raises the ambition for 2030:

Target for 2030	Law 7/2021	PNIEC updated in 2024
Reduction of greenhouse gas emissions compared to 1990	At least 23%	32 %
Share of renewable energy in final energy consumption	At least 42 %	48 %
Renewable electricity generation	At least 74 %	81 %
Improved energy efficiency	At least 39.5% (in primary energy consumption)	43% (in terms of final energy)

For the chemical industry, the relevance of these objectives lies in the fact that they directly affect the conditions under which the sector produces, consumes energy and invests in new technologies.

2. Financing industrial decarbonization

PERTE (Strategic Project for Economic Recovery and Transformation) for Industrial Decarbonization

It constitutes one of the main national instruments to support the transformation of manufacturing processes, although experience has revealed some limitations in its design and application.

The aid has been primarily aimed at financing the initial investment through calls for proposals subject to specific deadlines. However, many chemical industry projects require long maturation periods and face economic difficulties that persist throughout their operation.

This makes it necessary to complement the PERTE with other instruments capable of:

- Reducing investment risk.
- Covering some of the additional costs associated with low-carbon technologies.

Fund for the Promotion of Industrial Decarbonization (FIDI) and carbon contracts for difference

In this context, carbon contracts for difference can provide greater certainty to investments. Although PERTE already contemplated the study of a fund and a pilot project for this instrument, in **March 2026** the FIDI was created by **Royal Decree-Law 7/2026**.

Its **Section B** may be structured mainly through carbon contracts for difference to fully or partially offset the cost differential of decarbonized industrial technologies.

In July 2026, the approval process for the Draft Royal Decree regulating the carbon contracts for difference mechanism to support the decarbonization of energy-intensive industrial sectors within Section B of the FIDI was initiated through the opening of the prior public consultation.

3. Circular economy, waste and packaging

Spanish Circular Economy Strategy, Circular Spain 2030

The strategic framework is completed by this strategy, which establishes the general direction for moving towards a production and consumption model characterized by:

- Greater efficiency in the use of resources.
- Less waste generation.
- Greater utilization of materials throughout their life cycle.

The strategy is developed through successive action plans. So far, two have been approved:

- **First Circular Economy Action Plan 2021-2023.**
- **Second Circular Economy Action Plan, which** incorporates measures with an impact on the chemical industry, especially those aimed at promoting the use of by-products and secondary raw materials in production processes, as well as improving the quality and availability of recycled materials.

Law 7/2022, on waste and contaminated soils for a circular economy

Alongside climate and energy policy, the regulation of waste, packaging and the circular economy plays a fundamental role. Law 7/2022 incorporates into the Spanish framework a logic of transformation of the production and consumption model.

Its objective is not limited to managing waste once it has been generated, but seeks to move towards:

- More efficient use of resources.
- Reducing its environmental impacts.
- Strengthening prevention.

The Government has begun the process of updating it with the launch of a preliminary public consultation, although the end of the legislative term leaves the continuation of its processing and the possibility of its future approval uncertain.

Royal Decree 1055/2022, on packaging and packaging waste

This royal decree implements Law 7/2022 and specifies the circular logic in the specific area of packaging, imposing stricter requirements on:

- Its design and prevention.
- Its reuse and recyclability.
- Its subsequent management.



Furthermore, it reinforces the responsibility of those who put them on the market. The approval of future European regulations, such as the **Circular Economy Act planned for 2026**, will alter this framework.

4. Environmental control and industrial policy

Integrated pollution prevention and control

The national framework also relies on specific environmental control standards for industrial activity. The consolidated text of the Law on integrated pollution prevention and control, approved by **Royal Legislative Decree 1/2016**, establishes the basic regime applicable to facilities with the greatest polluting potential.

In the chemical industry, these standards subject the operation of plants to a **global environmental control**: in addition to regulating specific emissions, the overall impact of the facility on air, water, soil and the environment is assessed.

This regime is directly linked to the **European Directive on industrial emissions, amended in 2024**. The process of reviewing the national framework, already initiated with the public information period, will require adapting the integrated pollution prevention and control system to a more up-to-date and demanding approach to the environmental performance of industrial facilities.

Draft Law on Industry and Strategic Autonomy

This future regulation, if approved, would reinforce the strategic nature of industrial policy, improving administrative coordination and supporting productive activity.

Its approval would represent an update to the general framework for industrial planning and would reinforce the idea that the climate and environmental transition must be kept in line with the maintenance of a **competitive, safe and strategically relevant industrial base**.

However, the early end of the legislative term casts doubt on its future approval, as it is unlikely that a government of the opposite political persuasion would maintain it.

Adaptation to European regulations

The national framework must continue to adapt to the evolution of European regulations by transposing the directives that directly or indirectly affect the chemical sector.

Along with the aforementioned review of the **Industrial Emissions Directive**, it will be necessary to incorporate the modifications resulting from:

- The **Directive included in the Gas and Hydrogen package**, already partially incorporated by **Royal Decree 611/2026**.

- The **Energy Efficiency Directive, also partially incorporated**.
- The revision of the **Renewable Energy Directive, also partially incorporated through** Royal Decree 611/2026.

These regulations affect how industrial facilities consume energy, integrate renewable sources, and reorganize their production processes.

Similarly, regulations such as the **Net-Zero Industry Act**, although directly applicable, will foreseeably require complementary national measures to facilitate their development and implementation in Spain.

5. Demand creation through public procurement

Green Public Procurement Plan 2026-2033

Submitted to public consultation in September-October 2026, this plan seeks to strengthen the incorporation of environmental criteria in public procurement.

It can help boost the **demand for low-carbon and circular products**, favoring the viability of investments in decarbonizing the chemical industry. The early end of the legislative term leaves its final approval up in the air.

Regional and territorial dimension

The regional dimension is essential to understanding the transformation of the chemical industry in Spain, since a large part of the decisions that condition the industrial transition are adopted and applied at the territorial level.

Although the European and national frameworks described above establish the major objectives, their application depends on the specific characteristics of each territory. In this sense, the autonomous communities perform two functions:

- **Administrative execution** of the actions that condition the industrial transition.
- **Territorial planning,** adapting the general objectives to the material conditions of each industrial hub.

This territorial dimension is especially visible in the chemical industry, whose activity is concentrated in specific locations and maintains a close relationship with other production infrastructures.

3.2 Diagnosis of the Spanish chemical industry

3.2.1 Energy, emissions and circular economy

The activity of the chemical industry depends on energy-intensive processes and inputs that, in many cases, come from fossil sources or are associated with supply chains with a high environmental footprint.

Energy consumption and dependence on natural gas

In Spain, this requirement is clearly reflected in the energy consumption data of the sector. According to the Annual Statistics on Energy Consumption in Industry, in 2024 the chemical industry recorded the following consumption levels:

Indicator	Consumption in 2024
Total energy consumption	141,873 TJ
Electricity consumption	9,699.158 GWh
Energy intended for heat production	84,910.662 TJ
Energy intended for the production of high-temperature heat	58,037.463 TJ
Natural gas consumption	97,380.900 TJ

Source: Ministry for Ecological Transition and the Demographic Challenge (2024).

The structure of this consumption shows that the problem is not simply a matter of the total volume of energy used. The weight of **high temperature heat**, whose temperature is expressed in degrees Celsius (°C), is especially relevant because many chemical processes require intense and continuous heat inputs.

The consumption of natural gas also demonstrates the centrality of this source in meeting the energy

needs of the sector. This dependence has direct implications for its competitiveness, since both production costs and investment decisions are conditioned by:

- Gas price fluctuations.
- The availability of low-carbon alternatives.
- The development of solutions for industrial heat.

This pressure on competitiveness occurs in a context of high European electricity prices. In the second quarter of 2024, retail electricity prices for industry in the European Union were approximately **2.2 times higher than those in the United States** and **twice as high as those in China** (European Commission, 2025).

As the European Commission points out, the sector must move towards a substantial reduction of its emissions from a position of strong integration in industrial value chains and with a high dependence on fossil raw materials (DG GROW, 2023). Therefore, the transformation requires combining **energy, material and organizational changes**. Improving efficiency and reducing emissions must be addressed together, avoiding partial solutions that shift the environmental impact from one phase of the production cycle to another.

Cogeneration and regulatory transition

Cogeneration plays a relevant role in the energy supply of the chemical industry, by allowing the simultaneous production of electricity and useful heat in facilities with continuous thermal demands.

Its importance is linked both to fuel efficiency and to its contribution to meeting the electrical and thermal needs of industrial processes. However, the cogeneration fleet is going through a regulatory transition phase:

- **Current regime.** The specific remuneration scheme provided for in Royal Decree 413/2014 is limited by the regulatory useful life of the facilities. Plants that exceed this threshold cease to receive the corresponding returns on investment and operation.
- **Fleet renewal.** In 2026, the Government approved a new framework for the renewal of high-efficiency cogeneration through auctions of specific remuneration schemes for a total of **1,200 MW**, intended both for new installations and for the modification of existing plants.

Improving efficiency and reducing emissions must be addressed together, avoiding partial solutions.

- **Regulatory useful life.** For awarded natural gas cogeneration plants, the new scheme establishes a regulatory useful life of twelve years.

Material dependence and sustainability throughout the life cycle

Material dependence introduces an additional dimension of circularity. Several analyses warn that achieving climate neutrality depends not only on reducing direct emissions, but also on:

- Reducing the pressure on resources.
- Gradually replacing production models based on a linear consumption of raw materials.

This perspective broadens the scope of the necessary transformation in the sector (Zero Waste Europe, 2022). Along these lines, the Lowell Center for Sustainable Production (2023) argues that sustainable chemistry requires **designing products and processes that reduce impacts on human health and ecosystems from the outset**, integrating safety and harm reduction criteria throughout the life cycle.

Circularity of plastics and alternative sources of carbon

The plastics industry argues that circularity should involve a progressive reduction of dependence on fossil raw materials, replacing them with **circular and alternative carbon sources**.

In its roadmap, Plastics Europe (2023) proposes to move towards a more circular and climate-neutral plastics system by:

- The increase in **mechanical recycling**.
- The deployment of **chemical recycling** for flows that cannot be adequately treated mechanically.
- The use of **sustainable bio-based raw materials**.
- The incorporation of **captured carbon** as a resource for new products.

From this perspective, the transition of plastics is understood not only as a reduction in material



consumption, but as a change in the way of obtaining and reincorporating the carbon necessary to produce them. This requires improving waste recovery, expanding recycling capacities and creating market conditions that allow for the progressive replacement of fossil raw materials with circular resources and low-carbon alternatives (Plastics Europe, 2023).

The complementary role of chemical recycling

The AIMPLAS report Chemical recycling in Spain: Betting on a circular future (2022) points out that chemical recycling can complement mechanical recycling in the treatment of certain mixed plastic wastes, potentially contaminated or difficult to recycle by mechanical means.

These technologies make it possible to obtain secondary raw materials suitable for manufacturing products that require high performance and high quality standards. However, their development on an industrial scale requires:

- A stable regulatory framework.
- **Harmonized criteria on end-of-waste status**.
- The **recognition of mass balance as a certifiable methodology** to guarantee the traceability of recycled content.
- Greater collaboration between companies, public administrations and other actors in the value chain.

3.2.2 Geopolitics and the risk of deindustrialisation

The Spanish and European chemical industry faces its transition in an international context marked by high geopolitical uncertainty. Pressure on energy prices, industrial competition from other regions, and the vulnerability of certain supply chains have placed the sector in a particularly delicate position.

The transformation requires adapting production processes to a more demanding climate and environmental framework without losing industrial capacity or presence in strategic value chains. Therefore, the debate on the transition of the chemical industry is closely linked to **European strategic autonomy.**

International competition and loss of productive capacity

China: greater weight in world production and trade

Added to the energy pressure is a profound transformation of the global geography of chemical production. China has significantly strengthened its position and accounts for around **46% of global sales**, compared with the European Union's 13%. This development increases competitive pressure on European industry, especially in basic products and petrochemicals, where large-scale production and lower production costs give China a competitive advantage. The pressure is also reflected in trade flows: **China has become the main source of non-EU chemical imports into the European Union**.

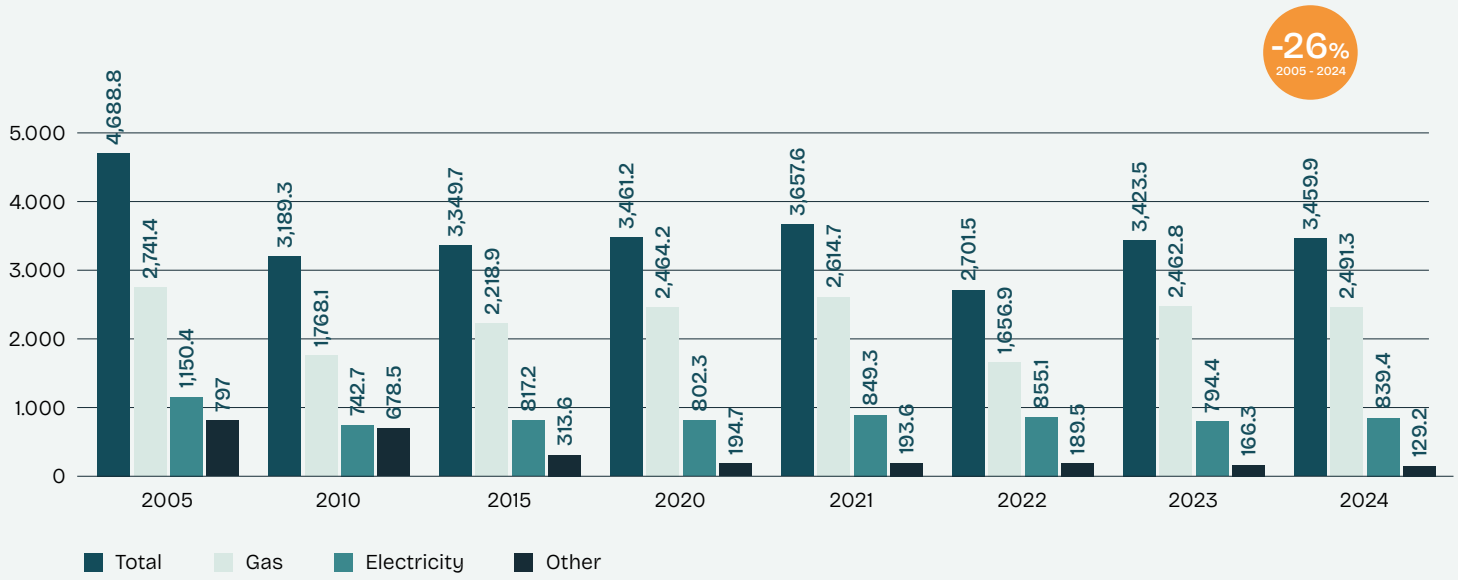
United States: cost advantage in petrochemical production

The United States is another significant source of competitive pressure for the European petrochemical industry. The high availability of ethane, associated with the growth of US natural gas production, provides a cost advantage in the production of ethylene compared to raw materials such as naphtha, which is more common in Western Europe. The US Energy Information Administration (EIA) notes that ethane cracking in the United States has historically generated higher margins than naphtha cracking.

Industrial closures and reduction of European capacity

The risk of loss of productive capacity has already begun to materialise. The European Action Plan for the Chemical Industry includes the following indicators:

Figure 2. Energy consumption in the chemical industry



Source: FEIQUE based on IDAE data

Indicator	Situation outlined in the Plan
Closures announced during the two years prior to publication	More than twenty large production centres in the European Union, including *steam crackers* and other basic chemical facilities
Cracking capacity lost over the last three years	Between 8% and 10%
Reduction that could be achieved with the planned closures	More than 20% compared to the existing capacity in 2021

Source: Plan de Acción Europeo para la Industria Química.

The disappearance of these facilities weakens the first links in numerous value chains, affects activities such as plastics, polymers and specialty chemicals, and increases European dependence on external supplies.

Energy security and exposure to international crises

Gas supply reconfiguration

The Russian invasion of Ukraine in 2022 led to a structural reconfiguration of the European Union's gas supply:

Procurement component	2021	2025
Weight of Russian gas in European imports	45 %	12 %
Share of liquefied natural gas (LNG)	20 %	45 %

Source: European Commission (2026).

This diversification has reduced dependence on a single supplier, but it has also increased European exposure to the dynamics of the global LNG market and to disruptions linked to supply, demand and international transport.

Strait of Hormuz: vulnerability of energy corridors

Added to this scenario are the restrictions on transit through the Strait of Hormuz, one of the world's main energy corridors. According to the US Energy Information Administration (2025), this passage carries a proportion close to **20% of the world's consumption of petroleum liquids**, as well as a significant part of the international trade in liquefied natural gas.

This succession of crises confirms that the energy security of European industry depends as much on the availability of resources as on the stability of maritime corridors exposed to:

- Conflicts.
- Logistical restrictions.
- Increased transport costs.

Energy costs and difficulties in financing the transformation

These crises have highlighted the exposure of European industry to high energy costs, especially relevant for an energy-intensive sector such as the chemical industry. FEIQUE (2024) highlights the importance of electricity costs for the energy-intensive industry and warns that the decarbonization of the Spanish chemical sector will require **very high investments**. This diagnosis coincides with that of Enrico Letta (2024), who points out that European energy costs continue to be higher than those of its main competitors and that this situation particularly affects energy-intensive industries. His analysis specifically includes the chemical industry among the sectors harmed by the energy crisis and highlights three sources of uncertainty for its transformation:

- The **cost of decarbonization technologies**.
- Access to financing.
- The **availability of these technologies on an industrial scale**.

Vulnerability of supply chains

The geopolitical dimension is also expressed in the vulnerability of supply chains. The chemical industry depends on raw materials, energy, technologies and equipment subject to international tensions. The energy crisis associated with the wars in Ukraine and Iran, and the reconfiguration of global trade relations have shown that external dependence can become a risk factor for strategic sectors.

In the chemical case, this vulnerability is especially intense because the sector supplies **intermediate products essential for numerous industrial activities**. A loss of chemical capacity in Europe would therefore have consequences for the entire productive fabric, as well as for companies in the sector.

Hormuz and the supply of petrochemical raw materials

The importance of the Strait of Hormuz for the chemical industry goes beyond the transport of oil and gas. This corridor also carries naphtha, liquefied petroleum gases, methanol and other intermediate products used in the petrochemical industry. According to the US Energy Information Administration (2025), in 2024 Asian markets accounted for **84% of crude oil and condensates** and **83% of LNG** that crossed the strait.

A prolonged disruption can reduce the utilisation of crackers and other facilities, successively affecting the production of ethylene, propylene, polymers, and numerous manufactured goods. Given the degree of international integration of the sector, these disruptions also end up affecting Europe through:

- Greater price volatility.
- Supply difficulties.
- More intense competition for available raw materials.

Fertilizers and food security

The Hormuz crisis, as was the case with the war in Ukraine, highlights the close connection between the chemical industry, fertilizer production and food security.

The Gulf countries occupy a relevant position in the international trade of urea, ammonia and other inputs needed for the manufacture of nitrogen fertilizers. The International Fertilizer Development Center (IFDC) (2026) has warned that disruptions in the supply and price of these products can exacerbate pressures on the global agri-food system and require greater international coordination.

The effects manifest themselves over different periods of time:

- **Energy impact: usually reflected** quickly in prices.
- **Impact on fertilizers and food: may become apparent** several months later, when the

The chemical industry depends on raw materials, energy, technologies and equipment subject to international tensions.

increase in agricultural costs is transmitted to the entire food chain.

Risk of deindustrialization and industrial policy responses

Relocation of production and carbon leakage

The risk of deindustrialization occurs when the demands for transformation are not accompanied by a higher profitability than would be obtained elsewhere in the world. If European industry faces higher energy costs, more demanding climate obligations and international competition less subject to equivalent carbon signals, there may be a **relocation of production to regions with lower costs or less stringent regulatory requirements**. This phenomenon would not necessarily reduce global emissions, but could shift them out of Europe and increase dependence on imports. Therefore, the debate on the **Carbon Border Adjustment Mechanism**, mentioned above, is key for emissions-intensive sectors. Sandbag (2025) argues that the progressive inclusion of chemicals in this mechanism would allow:

- Covering relevant gaps in the current system.
- Strengthening incentives for decarbonisation.
- Limiting the risk of carbon leakage as free allocation of allowances under the EU ETS is phased out.

Tools to transform industry and maintain its productive capacity

The response to the risk of deindustrialization should not rely on a general relaxation of environmental requirements. CAN Europe (2026) advocates an industrial policy based on predictable climate objectives, specific investment and creation of markets for clean products. This proposal is presented in response to a general deregulation strategy.

For their part, Carbon Market Watch and WWF (2025) argue that resources from the EU ETS and public support instruments should be more effectively directed towards industrial transformation and decarbonization. From this perspective, the problem lies not only in the existence of environmental regulation, but also in the **insufficiency or inadequate design of the energy, financial and market instruments** necessary for the industry to transform itself without losing productive capacity.

3.3 Transformation areas of the chemical industry

3.3.1 Technological and productive transformation

The European Commission envisions the transformation of the chemical industry as a process aimed at building a more sustainable and climate-neutral industry. In the sector's transition roadmap, this transformation is understood as a broad change that affects both emissions and the use of fossil raw materials, as well as resource efficiency, the incorporation of new technologies, and the evolution of production models (DG GROW, 2023).

Along the same lines, the roadmap developed by FEIQUE (2025) proposes addressing the objective in terms of climate neutrality, and not only decarbonization, given that carbon is not only a source of emissions, but also a structural component of numerous chemical products and processes. The proposal envisions the transformation as a comprehensive process that jointly modifies the energy and material base of the sector, with the purpose of progressively reducing dependence on fossil resources, strengthening circularity and addressing emissions that are particularly difficult to eliminate.

Electrification of industrial processes

One of the main lines of transformation is the electrification of industrial processes, especially when the necessary heat can be generated by renewable electricity. This route allows **reducing the consumption of fossil fuels** and taking advantage of the progressive decarbonization of the electricity system. However, its implementation in the chemical industry is not automatic, since many processes require high temperatures, operational continuity and complex technical integration with existing facilities. Agora Industry (2024b) underlines that the direct electrification of industrial heat presents significant potential in Europe, although its viability depends on the characteristics of each process, particularly the required temperature, the price of electricity and the availability of suitable infrastructure.

Conditions for its deployment

FEIQUE also attributes a fundamental role to electrification where it is technically and economically viable, but points out that its deployment requires action on its economic and infrastructural conditions. In this regard, it proposes **reducing the final cost of electricity through modifications to taxation, network charges and compensation for indirect costs**, in addition to **strengthening the capacity of the network**. It also proposes to **facilitate industry access to renewable supply contracts, self-consumption** and **storage**. These actions should be integrated into a broader framework of legal certainty and administrative streamlining that provides certainty for investments.

Complementary technological solutions

However, electrification is integrated into a diversified technological strategy that includes complementary solutions for those processes where the direct replacement of fossil fuels is not viable. In this area, FEIQUE attributes a relevant role to **hydrogen**, to **alternative sources of heat and steam** and, for certain emissions that are difficult to avoid, to **carbon capture and management**.

Circularity and carbon management as a resource

Circularity constitutes another fundamental dimension of the transformation of the sector. In a material-intensive industry, **reducing the demand for virgin raw materials** and **making better use of existing resources** can decrease the environmental and energy pressure of the sector. Cefic (2024) insists on the need to manage carbon as a resource, not just as an emission that must be eliminated. This perspective involves **progressively replacing virgin fossil carbon** with alternative sources, such as sustainable biomass, recycled waste and captured CO_2, as well as **combining mechanical and chemical recycling** to keep materials and carbon within the production cycle where it is technically and environmentally viable. For all these reasons, the chemical industry is one of the sectors where advances in the circular economy can lead to a more intense transformation.

Organizational and market conditions

Academic literature has emphasized that the decarbonization of the chemical industry should be understood as a **sociotechnical process**, in which the deployment of process innovations depends on their interaction with existing industrial practices, available infrastructures, the organization of value chains and market conditions (Chung et al., 2023). This warns against the temptation to rely solely on technical improvement, without considering the conditions that make it possible.

3.3.2 Economic and industrial conditions for deployment

The transformation of the chemical industry does not depend solely on the availability of technological solutions. For these to be implemented on an industrial scale, adequate economic conditions must exist. This issue is especially relevant in a capital-intensive sector, characterized by complex facilities,



long investment cycles, and strong exposure to international competition. The transition requires a profound reconfiguration of production processes, from the incorporation of new energy sources to the adaptation of existing plants and the progressive replacement of certain inputs. However, these changes can only be sustained if there is a framework that allows for high costs to be incurred without compromising the continuity of industrial activity.

Competitive and progressively decarbonized energy

As already mentioned in the previous section, energy cost is one of the most determining factors for the viability of the transition. The chemical industry needs **abundant, competitive** and **progressively decarbonized** energy to maintain its production and reduce emissions. In this regard, the National Energy and Climate Plan 2023-2030 foresees very significant investments in renewables, networks, electrification and energy efficiency (Ministry for Ecological Transition and the Demographic Challenge, 2024). For the chemical sector, these elements are crucial because the viability of many decarbonization options depends on having a low-emission energy supply capable of meeting the needs of the industry, both in terms of **stability and cost and effective availability in industrial territories**.

Renewable generation and final cost of electricity

At this point, it is important to distinguish between the availability of renewable electricity and the final cost of electricity for industry. The viability of industrial electrification depends not only on increasing renewable generation, but also on its potential economic advantages being effectively passed on to the industrial consumer. The Alliance for the Competitiveness of Spanish Industry (2026) points out that, despite Spain's renewable potential, the final price borne by industry is increased by components outside the wholesale market, such as balancing services (including technical constraints), network charges, other regulated charges and taxes. According to the comparative analysis included in the report, for the energy-intensive profiles considered, the final cost of electricity in Spain is higher than that estimated for France and Germany, which reduces industrial competitiveness and may hinder investments in electrification and decarbonization.

Infrastructure and planning of industrial parks

Infrastructure is a material condition of transformation. It is not enough for low-carbon technologies to exist; industrial plants must be able to connect to an energy and logistics environment capable of supporting their implementation. This implies having:

Reducing the demand for virgin raw materials and making better use of existing resources can decrease the environmental and energy pressure of the sector.

- Reinforced electrical networks.
- Sufficient access to renewable energy.
- Hydrogen-related infrastructure.
- Solutions for managing captured carbon, in certain cases.

The European Commission stresses that the transition of the chemical industry requires close coordination between private investment, public support and shared energy infrastructure planning (DG GROW, 2023). This dimension is particularly important in chemical hubs, where industrial concentration can facilitate economies of scale, but also demands more precise territorial and energy planning.

Investment and financing needs

European dimension

Regarding the economic dimension, Accenture and NexantECA (2022) estimate that the transformation of the European chemical industry towards net zero emissions will have **costs exceeding one trillion euros**. The study also identifies a significant funding gap and points out that certain investments will need incentives and support mechanisms to achieve **returns comparable to those of conventional projects**. At the same time, it argues that the increased demand for low-carbon, sustainable and circular products can generate growth opportunities and competitive advantages for European companies that anticipate this transformation. Based on this analysis, it can be stated that the challenge lies not only in the availability of technologies, but also in the existence of economic conditions that allow financing their implementation and **transforming decarbonization into an opportunity for future competitiveness**.

Investment needs in Spain

In the case of Spain, the roadmap presented by FEIQUE estimates needs between 2025 and 2050:

Concept	Approximate amount
Total investment needs	€65 billion
Investment that could be covered by the expected levels	€55 billion
Additional funding gap	€10 billion

Source: FEIQUE 2025

Total needs amount to approximately €2.6 billion a year. Of the total, around €55 billion is expected to be covered by the expected levels of investment, leaving an additional funding gap of around €10 billion, or €400 million a year.

Uncertainty and cost differential

Financing represents another fundamental limitation: industrial decarbonization requires very high investments with long-term returns, while many companies operate in global markets under cost pressure. The Draghi report on European competitiveness insists that Europe can no longer rely on some of the conditions that favored its growth in the past, including cheap energy or geopolitical stability (Draghi, 2024). In this context, the transition of the chemical industry can only advance if uncertainty for investment is reduced and if companies have financial instruments capable of covering part of the cost differential associated with **clean technologies, alternative raw materials and adaptation of facilities**.

Product demand

In addition to financing the supply, it is necessary to **stimulate the demand for chemicals** and **materials with lower climate impact**. One of the difficulties of the industrial transition is that these products often have higher costs in their early stages of deployment, while the market does not always recognize their environmental value. Agora Industry (2024a) and Clean Air Task Force (2025) argue that lead markets for low-emission industrial materials and products can be built through frameworks that combine **technical criteria, certification** and **regulatory or public procurement signals linked to the climate footprint of products**.

> The Draghi report on European competitiveness insists that Europe can no longer rely on some of the conditions that favoured its growth in the past.

International competitiveness and protection against carbon leakage

International competitiveness directly influences these decisions. If European companies assume decarbonization costs that do not exist in other markets, the risk of **carbon leakage and production relocation increases**. This risk particularly affects emissions-intensive sectors exposed to international trade. The debates on the Carbon Border Adjustment Mechanism show precisely the need to protect the climate integrity of the European market without weakening the export capacity of industry. Agora Industry (2025) warns that the design of the CBAM must consider the situation of European exporters to prevent companies investing in decarbonization from losing competitiveness in global markets.

CBAM coverage in the chemical industry

Sandbag (2025) argues that the limited coverage of the chemical industry in the current CBAM framework constitutes a significant weakness of the mechanism. Although this already includes certain chemicals, **especially fertilizers** and **hydrogen**, most organic chemicals, polymers and refined products remain outside its scope. This exclusion is significant, given that, according to the report itself, chemical plants and refineries account for around **36% of industrial emissions covered by the EU ETS. From this perspective**, a gradual expansion of the CBAM to these value chains would allow **strengthening protection against imports subject to a lower carbon signal and extending incentives for decarbonization**, in parallel with a possible progressive reduction of the free allocation of allowances (Sandbag, 2025).

Material efficiency and circularity as factors of competitiveness

The economic viability of the transition is also linked to the efficiency in the use of materials. Zero Waste Europe (2022) warns that climate neutrality cannot be achieved solely by replacing energy sources, but requires **reducing the material pressure of the economy and rethinking certain patterns of production and consumption**. For the chemical industry, this perspective implies that future competitiveness will depend on its ability to move towards more circular models, in which the use of resources and the incorporation of secondary raw materials will reduce exposure to supply risks and

respond to a growing demand for products with less environmental impact.

Investor sustainability criteria

The role of investors introduces additional pressure. Chemical sustainability is observed not only by regulators and consumers, but also by financial actors interested in reducing risks associated with hazardous substances. The Hazardous Chemicals Investors Initiative, coordinated by ChemSec, shows how large investors are incorporating the management of substances of concern into their business assessment criteria (ChemSec, n.d.). This trend may affect access to financing for chemical companies, favoring those that demonstrate greater transparency and adaptation to more demanding environmental standards.

3.3.3 Social and territorial dimension

Social licence to operate

Since it is an activity with facilities concentrated in certain territories, with perceived environmental and health risks and with a strong relationship with local industrial employment, its viability depends on a socio-territorial variable: the continued acceptance by the affected communities and actors. This idea can be analyzed through the concept of social licence to operate, understood as the level of acceptance or legitimacy that a business activity obtains from its social environment, beyond the formal compliance with administrative permits. In sectors subject to environmental scrutiny, this licence is built on trust, the quality of the relationship with the community, the perception of fair treatment and procedures, and the company's ability to prevent or mitigate the impacts of its activity (Gunningham et al., 2004; Moffat & Zhang, 2014).



Quality of employment and a just transition

The social dimension of the industrial transition also includes the participation of workers and their representative organizations. UGT (2025) warns that the EU Clean Industrial Deal, although it can contribute to strengthening the competitiveness and decarbonization of industry, must be accompanied by sufficient social guarantees to prevent the productive transformation from resulting in job losses or precariousness. From this perspective, a just transition requires effective mechanisms for social dialogue, union participation in the planning of industrial changes, and training and retraining policies that allow professional skills to be adapted to new technologies and production processes.

According to FEIQUE's Snapshot of the Spanish Chemical Sector (2026), the latest available data show that permanent contracts account for around 94% of the sector's workforce and that the average annual salary exceeds €43,000.

For its part, the report prepared by Roland Berger for Cefic (2026) estimates that the closures announced between 2022 and 2025 affect some 20,000 direct jobs in Europe. For Spain, it estimates approximately 3,000 affected jobs, including direct and indirect ones.

Territorial information and participation

In the chemical industry, territorial information and participation take on particular importance. The sector's activity generates economic benefits and skilled employment and maintains a close relationship with the territories in which it operates. Therefore, the social acceptance of its transformation depends not only on the reduction of greenhouse gas emissions, but also on nearby communities having rigorous and accessible information on the environmental and safety performance of the facilities. Decarbonization must also be accompanied by credible monitoring mechanisms and stable channels for dialogue and participation that allow the concerns of those living near industrial centers to be addressed and incorporated.

Social perception and risk communication

Although it is difficult to measure the degree of territorial acceptance of the chemical industry in

Europe, there are studies that show negative social perceptions or limited knowledge in relation to chemical substances. Siegrist and Bearth (2019), based on a survey of 5,631 people in eight European countries, report, among other results, that 30% of those surveyed said they were afraid of chemicals, 40% said they tried to avoid them in their daily lives, and 39% said they would like to live in a world without chemicals. These data do not measure the acceptance of specific industrial facilities, but they do highlight the importance of strengthening knowledge, risk communication, and dialogue with society.

Voluntary commitments and public oversight

The chemical industry itself has historically promoted voluntary initiatives such as Responsible Care, aimed at the continuous improvement of performance in safety, health, environment and social responsibility, complementing applicable legal obligations. These initiatives can also contribute to strengthening transparency, dialogue with stakeholders, and public trust. Their role is complementary to, and not a substitute for, public regulation and the supervisory mechanisms it provides for.

However, these types of voluntary programs do not replace the need for binding rules, independent verification mechanisms, and effective accountability systems. In this regard, a recent assessment by the European Environmental Bureau (EEB) and ClientEarth (2026) warns that the lack of transparency, delays in adopting restrictions and pressure exerted by certain industrial interests continue to hinder the effective control of the most dangerous chemicals in the European Union. From this perspective, voluntary initiatives can complement regulation, but their effectiveness depends on their integration into a public framework capable of verifying results, demanding compliance with obligations, and correcting breaches.

3.3.4 Regulatory framework and governance of the transition

The transition of the chemical industry does not depend solely on the existence of standards, strategies or plans, already analysed in previous sections. The European, national and regional frameworks establish climate, energy and industrial objectives that condition the activity of the sector. However, the central problem is not only regulatory, but also one of **governance: how to ensure that these objectives translate into an effective transformation of production processes**. Therefore, it is important to emphasize the complementary nature of the various instruments used: the regulations that set climate ambition must be supported by others that establish mechanisms that serve as a lever for the sector.

The social licence to operate is built on trust, the quality of the relationship with the community, the perception of fair treatment and procedures, and the company's ability to prevent or mitigate the impacts of its activity.

Consistency between policies that affect the sector

The governance of the transition must prevent policies affecting the chemical sector from progressing along separate tracks. When **decarbonization, chemical safety and industrial policy** are designed without sufficient connection between each other, companies may receive conflicting signals and the solutions adopted may shift the problem from one area to another. In this sense, the Clean Industrial Deal is relevant because it attempts to link the **decarbonization of industry with competitiveness** and **with the elimination of administrative obstacles to productive investment**, without presenting these objectives as completely separate dimensions.

European coordination and single market integration

Priorities, resources and coordinated actions

The Draghi report (2024) identifies a gap between the European Union's ability to set common goals and its ability to support them through **clear priorities, sufficient resources and coordinated actions**. The report notes that **the fragmentation of the single market**, the **dispersion of resources** among numerous national and European instruments and the **lack of coordination between industrial, energy, trade and financial policies** reduce the effectiveness of European action. In particular, it warns that decarbonization will only constitute an industrial opportunity if it is accompanied by a coherent plan that links energy policy with competitiveness and allows companies to benefit from clean and affordable energy (Draghi, 2024).

Energy and financial integration

This diagnosis converges with that formulated by Letta (2024), who recalls that areas essential to industrial activity, such as energy and financial markets, remain insufficiently integrated and continue to be organized largely through national frameworks. According to Letta (2024), this fragmentation **limits**



economies of scale, hinders the mobilization of investment and **reduces the European capacity** to develop an effective industrial policy. Applied to the chemical industry, this implies that meeting climate objectives depends on governance capable of coherently articulating the necessary conditions for the transformation of the sector. Governance is therefore not a secondary administrative issue, but **a condition for regulatory obligations to be able to translate into an effective transformation of industrial facilities**.

Articulation of the Spanish strategic framework

In the Spanish case, the **National Energy and Climate Plan 2023–2030 establishes** the general framework for action in energy and climate matters. On the one hand, it sets the country's objectives in the different aspects of the climate transition and, on the other hand, **compiles the set of measures planned to achieve them** (Ministry for Ecological Transition and the Demographic Challenge, 2024c). Given the cross-cutting nature of the chemical industry, it is affected directly or indirectly by much of what is included in the plan, so it constitutes a fundamental criterion for the strategic orientation of the activity. However, it should be noted that these strategic governance instruments must contribute to **reducing the gap between strategic ambition and the material conditions that allow them to be applied**.

Monitoring, transparency and evaluation of results

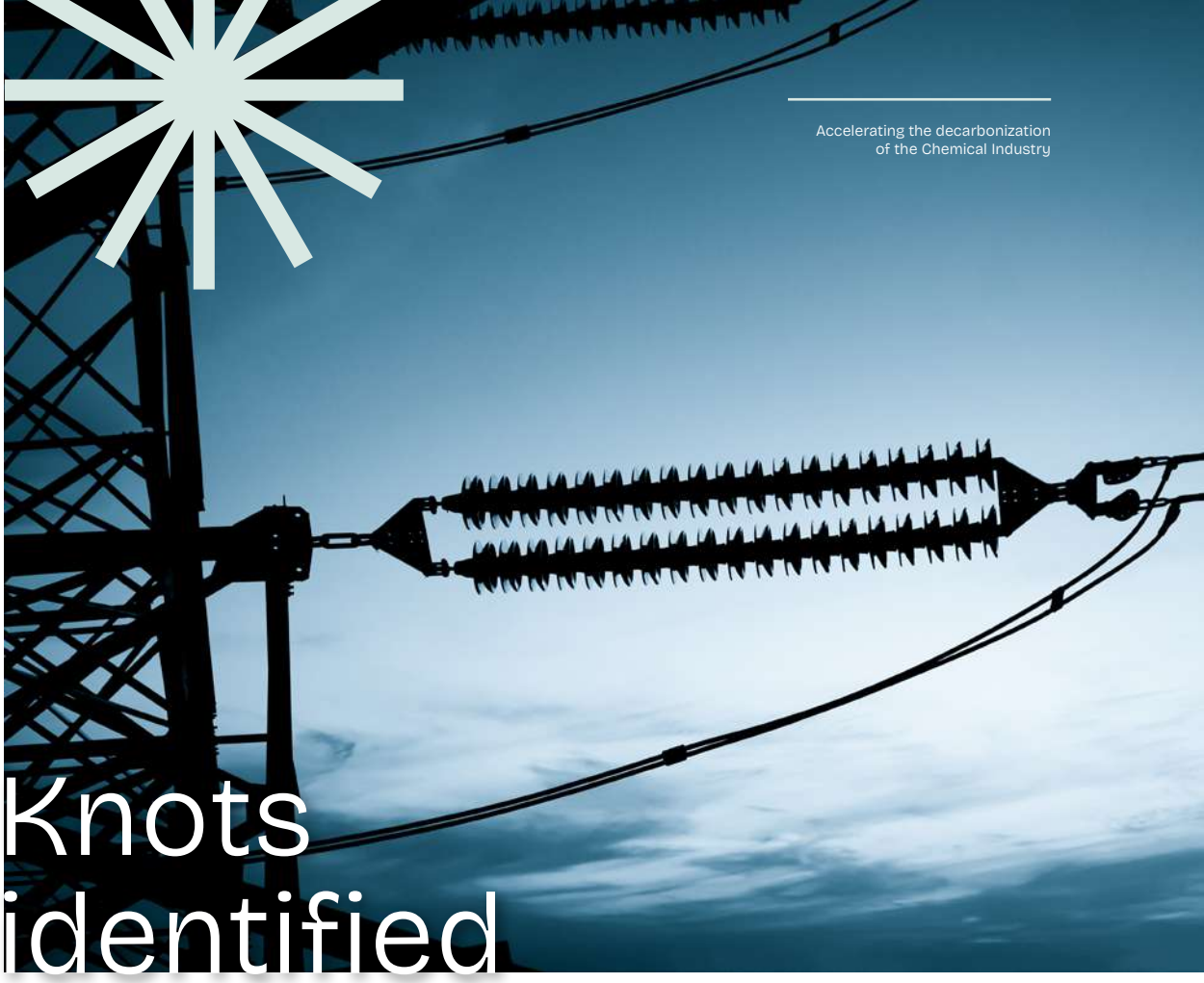
Proper follow-up is another key element. On a global scale, the International Energy Agency (2023) warns

The National Energy and Climate Plan 2023–2030 establishes the general framework for action in energy and climate matters.

that the chemical sector is not yet progressing at the necessary pace to fully align with climate neutrality pathways. This finding demonstrates that general objectives alone do not transform the sector. Without **comparable information, periodic review** and **transparency on results**, governance risks being confused with a mere production of plans. In the chemical industry, measuring the transition requires checking whether the transformation **effectively reduces the structural impacts of the sector** and not just whether it improves some of its **most visible climate indicators**.

Corporate responsibility and sectoral commitments

Corporate responsibility can contribute to this process within a framework of clear public obligations. Sectoral initiatives such as **Responsible Care** can promote continuous improvement in safety, health, environment and social responsibility, complementing the regulatory framework through commitments, indicators and monitoring and evaluation mechanisms. Its role should be understood as complementary to, and not a substitute for, public regulation.



04 Knots identified

Throughout the three sessions of the Working Group, **a set of issues affecting the decarbonization of the Spanish chemical industry has been identified**. These bottlenecks should not be understood as isolated obstacles, but as interdependent factors that simultaneously affect the technological, economic, regulatory, financial, social and industrial viability of the transition.

Likewise, the heterogeneity of the chemical sector means that the intensity and nature of these barriers vary between subsectors, production processes and territories. Therefore, the diagnosis must be interpreted from a sectoral perspective, but flexible enough to recognize the specific needs of each subsector, which have different levels of energy intensity, international exposure and technological maturity.

With this in mind, the following are the categories of knots identified during the presentations and conversations held during the aforementioned sessions:

4.1 Energy and electrification

4.1.1 High energy cost and competitive disadvantage

High and volatile electricity and gas costs reduce the competitiveness of the chemical industry and make investment planning difficult. Added to this are taxes, regulated charges, network charges and balancing services, as well as compensation for indirect CO_2 costs that is lower than in other European countries, which is especially relevant for energy-intensive activities.

4.1.2 Insufficient network capacity and infrastructure

The limited capacity of electrical networks and the uncertainty about access to the necessary power make it difficult to electrify existing facilities and new projects. The deployment of electrification, renewable hydrogen, storage, and other heat sources also requires shared infrastructures whose planning is not yet fully aligned with industrial needs.

4.1.3 Dependence on gas and decarbonization of industrial heat

Many chemical processes continue to rely on gas to generate heat and steam under conditions that are difficult to achieve through direct electrification. Its replacement is conditioned by the characteristics of each process and by the technical and economic viability of alternatives such as biomass, thermal storage or solar thermal, whose application also depends on the availability of resources and territorial conditions.

4.2 Regulation and institutional framework

4.2.1 Regulatory complexity and administrative burden

The accumulation of requirements and the complexity of administrative procedures delay projects, increase their costs and hinder regulatory compliance, especially for SMEs.

4.2.2 Instability and lack of regulatory predictability

Regulatory changes and uncertainty about the evolution of energy, climate, and industrial policies make long-term planning and investment difficult.

4.2.3 Insufficient harmonization between European and national levels

Differences in the interpretation and application of regulations between countries and administrations generate legal uncertainty and unequal conditions of competition.

4.2.4 Insufficient coherence between public policies

The lack of alignment between climate, energy, industrial, environmental and trade policies can generate conflicting requirements and limit the effectiveness of the measures taken.

4.2.5 Uncertainty in the application of the EU ETS and the Carbon Border Adjustment Mechanism

The application of the EU Emissions Trading System (EU ETS) and the Carbon Border Adjustment Mechanism (CBAM) creates uncertainty about their ability to prevent unfair competition, industrial relocation and emissions shifting.

4.2.6 Insufficient capacity for market surveillance and control

The lack of resources to verify compliance with the requirements applicable to domestic and imported products makes it difficult to guarantee fair competition and protect the European market.

4.3 Demand and market

4.3.1 Insufficient demand for sustainable products

Demand for sustainable chemicals remains limited, especially when they involve an additional cost that consumers or purchasing sectors are unwilling to bear.

4.3.2 Lack of price signals and lead markets

The absence of price signals and instruments that value environmental benefits hinders the creation of lead markets and reduces the competitiveness of sustainable alternatives compared to conventional ones.

4.3.3 Disconnection between innovation, financing and demand

The lack of coordination between technological development, financing instruments, and market

needs limits the scaling and commercialization of innovative solutions.

4.3.4 Limited use of green public procurement

Green public procurement is still underutilized in order to boost demand for products with a lower environmental impact and promote their market penetration.

4.3.5 Insufficient environmental labelling and certification systems

The lack of clear and harmonized labelling, classification and certification systems makes it difficult to compare products, prove their environmental benefits and build trust in the market.

4.4 Geopolitics and supply chains

4.4.1 Vulnerability of supply chains and logistics corridors

Value chains, configured to operate under conditions of stability and efficiency, have a limited capacity to absorb prolonged disruptions. Dependence on logistics corridors exposed to geopolitical tensions can lead to availability problems, delays, and increased costs.

4.4.2 External dependence on strategic resources, technologies and products

External dependence on gas, raw materials, technologies, chemicals and fertilizers reduces the operational autonomy of the sector and exposes production to trade restrictions, political decisions and price fluctuations occurring outside of Spain and the EU.

4.4.3 Prioritizing cost versus resilience

Selecting suppliers and technologies based primarily on the lowest cost can reinforce new external dependencies by relegating criteria such as security of supply, resilience, and strengthening European industrial capacity.

4.5 Measurement and traceability

4.5.1 Non-harmonized methodologies and limitations of carbon accounting

Differences in criteria, limits, and procedures make it difficult to compare emissions and distinguish reductions resulting from technological improvements, efficiency, electrification, or carbon recovery from those associated with changes in production or facility closures.

4.5.2 Insufficient traceability of renewable and recycled content

The lack of harmonized systems to verify renewable or recycled content throughout the value chain makes it difficult to certify their environmental attributes. In plastics, this deficiency particularly affects the recognition of chemical recycling and mass balance.

4.5.3 Complexity of measuring emissions in fertilizers

The variability of agronomic conditions and the lack of direct analytical methods make it difficult to quantify and compare scope 3 emissions and those generated during the application of fertilizers to the soil.

4.5.4 Difficulty in measuring and attributing indirect emissions

The lack of comparable data and common information exchange systems makes it difficult to attribute emissions generated among suppliers, producers, and customers.

4.5.5 Insufficient baselines and MRV systems

The lack of sectoral baselines and robust measurement, reporting, and verification systems limits the evaluation of projects and the development of instruments such as carbon contracts for difference.



4.5.6 Limited information on environmental and health impacts

The lack of data and monitoring methodologies makes it difficult to identify and compare the environmental and health impacts of industrial activity and to provide rigorous information to territories and society.

4.6 Competitiveness and industrial transition

4.6.1 International competitive pressure and weakness of European value chains

International differences in energy costs, regulatory requirements, speed of execution and public support put the European industry at a disadvantage. This is compounded by the insufficient European production of technologies, equipment and components needed for decarbonization.

4.6.2 Risk of loss of profitability, productive capacity and employment

The costs of technological transformation can reduce profitability, especially when they cannot be passed on to the market. This situation can lead to a loss of investment, production and employment, as well as the relocation of activities and emissions.

4.6.3 Balance between sustainability, competitiveness and strategic autonomy

The industrial transition requires reconciling emissions reduction with business profitability and the preservation of strategic productive and technological capabilities.

4.7 Governance and coordination

4.7.1 Insufficient public-private coordination and collaboration

The lack of coordination between administrations, industry, research centers and value chains generates territorial differences and makes it difficult to establish stable mechanisms to promote innovation, infrastructure, investment and market creation.

4.7.2 Limited capacity to influence technical standards

The fragmented participation of the sector reduces its ability to incorporate the needs of Spanish industry into European and international standards in a coordinated manner.

4.7.3 Gap between planning and implementation

The lack of concrete instruments, monitoring mechanisms, and defined responsibilities makes it difficult to translate general strategies and objectives into effective actions and results.

4.7.4 Insufficient territorial and social integration

Governance does not always adequately incorporate territorial, environmental, and labor impacts. The lack of participation, transparency, and balanced distribution of costs and benefits can generate

conflicts and delay the deployment of technologies and infrastructures.

4.7.5 Lack of a shared definition of priorities

The absence of stable mechanisms to reconcile interests makes it difficult to anticipate needs, align investments, and concentrate resources on strategic industrial, productive, and technological priorities.

4.8 Investment and financing

4.8.1 High costs and long payback periods

High investment and operating costs, differences in abatement costs, and long payback periods hinder the viability of projects, especially when the additional costs cannot be passed on to the market.

4.8.2 Uncertain economic conditions for investment

The volatility of energy and carbon prices, along with uncertainty about future demand, available infrastructure, and economic signals for assessing emissions reductions, limits long-term investment decisions.

4.8.3 Insufficient instruments to reduce risk and guarantee bankability

Aid focused on eligible costs does not always cover commercial, regulatory, and operational risks, nor does it guarantee private financing. There is a lack of instruments adapted to the technological maturity and risk profile of the projects that stabilize income and facilitate scaling.

4.8.4 Fragmentation and mismatch of support instruments

The diversity of requirements, schedules, and procedures, along with the administrative burden, makes financial planning difficult. Furthermore, the deadlines for calls for proposals do not always align with the engineering, authorization, and execution cycles of industrial projects.

4.8.5 Unequal access and limited capabilities in SMEs

Territorial differences in access to information and advice, along with a lack of specialized capabilities in regulation, engineering, financing and project preparation, make it particularly difficult for SMEs to participate.

4.9 Technology and deployment

4.9.1 Uneven technological maturity and heterogeneity between subsectors

The technologies have different levels of maturity, costs, and implementation times. The diversity of processes, operating conditions, and abatement costs makes it difficult to replicate solutions and requires support tailored to each subsector.

4.9.2 Lack of competitiveness and infrastructure for renewable hydrogen

The high costs of renewable hydrogen and the lack of transport, distribution and storage networks limit its deployment. Adapting industrial facilities also requires additional investments.

4.9.3 Barriers to CCUS deployment

The development of CCUS is limited by regulatory and financial barriers, a lack of consolidated infrastructure and standards, uncertainty about its role in industrial decarbonization, and a lack of social consensus.

4.9.4 Limited scope of efficiency and complexity of combining technologies

Energy efficiency alone does not allow climate neutrality to be achieved. The need to combine it with electrification, hydrogen, CCUS, circularity and raw material substitution increases the complexity and uncertainty of investments.

4.9.5 Digitalisation and insufficient technical capabilities

The lack of data, control systems, digital tools, and specialized professionals hinders the integration and efficient deployment of new technologies.

4.10 Raw materials and circularity

4.10.1 Limited and unstable availability of alternative raw materials

The replacement of fossil raw materials is conditioned by the availability, cost, sustainability and stability of renewable and circular resources. Alternatives such as biomass, plastic waste, or recovered CO_2 are not unlimited or suitable for all uses.

4.10.2 Regulatory barriers to using by-products and waste

Restrictions on the use of by-products, delays in declaring the end of waste status, and administrative complexity make it difficult to incorporate secondary resources into industrial processes.

4.10.3 Lack of harmonization and recognition of chemical recycling and mass balance

Regulatory differences and the absence of common criteria on traceability, certification and recycled content limit the valorisation of circular products and the recognition of chemical recycling and mass balance.

4.10.4 Limited regulatory recognition of CO_2 as a raw material

Regulatory frameworks do not always adequately recognize the contribution of recovered CO_2 to emissions reduction, hindering its use in new products and the development of closed carbon cycles.

4.10.5 Insufficient integration of ecodesign and decisions that limit recyclability

Circularity continues to be incorporated mainly at the end of the life cycle. The mixture of materials, certain additives, and the lack of standardization reduce the possibilities for separation, reuse, repair, and recycling.



4.10.6 Technological and economic difficulties in scaling up chemical recycling

The diversity and uneven maturity of technologies, the heterogeneity of waste, and high investment costs hinder the development of plants adapted to each waste, product, and industrial process.

4.10.7 Insufficient demand for recycled materials

The lack of stable markets and predictable price signals for recovered materials reduces the viability of recycling capabilities and makes it difficult to sustain long-term investments.

4.10.8 Insufficient prevention, reuse, recovery and valorization

The persistence of single-use products and the limited integration of preventive criteria keep numerous wastes and secondary resources underutilised. This situation limits the contribution of circularity to reducing external dependencies and strengthening value chains.

4.10.9 Insufficient nutrient recovery in the fertilizer sector

The limited recovery of nutrients from waste and by-products maintains dependence on fossil or imported inputs and hinders the transformation of the fertilizer industry.

Taken together, the identified bottlenecks show that the decarbonization of the chemical industry constitutes a structural transformation that transcends the sector itself. Its progress depends on the interaction of energy, regulatory, financial, technological factors and those linked to circularity, competitiveness, strategic autonomy and just transition. This interdependence is reflected in the roadmap presented below, which is aimed at identifying and prioritizing the measures with the greatest capacity to enable and accelerate the transformation of the chemical sector.



05 Roadmap

Based on the identified bottlenecks, **alinnea** proposes a roadmap to guide the decarbonization of the Spanish chemical industry. Its purpose is to translate the diagnosis shared by the participants of the Working Group into an ordered sequence of measures capable of eliminating barriers, mobilizing investment, deploying technologies, creating markets for low-carbon and circular products, strengthening traceability and preserving the competitiveness and productive capacity of the sector.

The roadmap organizes these measures into **three time horizons (short, medium and long term) according to** the function they perform within the transformation process. The **short term** is aimed at unlocking the barriers that currently prevent the activation of projects or the generation of minimum investment conditions; the **medium term** seeks to scale technologies, infrastructures, markets and financial instruments once the main enabling conditions have been established; and the **long term** aims to structurally transform the sector, consolidating a climate-neutral, circular, competitive, resilient and socially legitimate industrial model.

The measures are grouped into **four major areas of action**. First, the **enabling conditions**, which include the energy, regulatory, administrative, economic and financial reforms needed to facilitate investment. Secondly, **technologies and decarbonization**, which brings together actions linked to energy efficiency, electrification, renewable hydrogen, thermal storage, CCUS, recycling, alternative raw materials and the reduction of process emissions. Thirdly, **demand and market**, focused on creating demand signals, developing lead markets and strengthening certification, labelling, Green Public Procurement and the bankability of projects. Finally, **competitiveness and strategic autonomy**, which incorporates measures aimed at preserving productive capacity, preventing carbon leakage, strengthening European value chains, diversifying supplies and ensuring equivalent competitive conditions.

Likewise, the measures are classified into **high, medium and low priorities** according to their recurrence in the dialogue of the Working Group, their capacity to enable other actions, their impact on industrial transformation, the urgency and risk of inaction, and their technical, regulatory, financial, administrative or market viability.

Therefore, the roadmap should be understood as an implementation sequence and a strategic framework adaptable to the evolution of technological, regulatory, economic and market conditions.

Roadmap

	SHORT TERM 0-2 years | Unlock	MEDIUM TERM 3-5 years | Scale up	LONG TERM 5+ years | Transform
Enabling conditions	Reduce industrial energy costs Streamline permits Regulatory stability Reinforcement of electrical networks Financing instruments (CCfDs) Market and customs surveillance MRV methodologies Simplifying access to aid Territorial governance	H_2 and CO_2 infrastructure Coordinated energy-industrial planning EU harmonized standards Financial system aligned with industrial decarbonization	Energy system fully integrated with industry
Technologies and decarbonization	Energy efficiency Initial electrification CCUS pilots Chemical recycling validation	Scaling electrification Renewable hydrogen CCUS infrastructure Industrial chemical recycling Circular integration of secondary raw materials	Circular industrial processes
Demand and market	Green Public Procurement Environmental labelling Certification Traceability of low-carbon products	Mandatory quotas Recycled content required European lead markets Circular consumption models and reuse	Full internalisation of carbon value
Competitiveness and strategic autonomy	ETS and CBAM Protection against unfair competition Strengthening supply chains	European industrial capabilities European technology production Diversification of supplies	European strategic industrial autonomy

Strategic priority: High Medium Low

5.1 Development of the measures

5.1.1 Enabling conditions

The transformation of the chemical industry depends on the existence of an energy, regulatory, financial and institutional environment that allows decarbonization projects to become technically and economically viable investments. Although certain actions may not generate immediate reductions in emissions, their development is essential for electrification, renewable hydrogen, circularity, or the substitution of fossil raw materials to be deployed on an industrial scale.

Enabling conditions include, in particular, the reduction of energy costs, the strengthening of electricity networks, administrative streamlining, regulatory stability, the adaptation of financial instruments, the development of measurement and traceability methodologies, market surveillance, and coordination between different actors and administrative levels.

5.1.1.1 Industrial energy costs, networks and infrastructure

The cost of electricity conditions the competitiveness and decarbonization of the chemical industry. Electrification, renewable hydrogen, and thermal storage will increase their consumption, so their deployment will require competitive, stable, and predictable energy.

Despite the availability of renewables, an energy-intensive consumer can pay €58.78/MWh in Spain, compared to €22.05/MWh in France and €43.23/MWh in Germany. This gap is due to balancing services, network charges, taxes and lower compensation for indirect CO_2 costs (AEGE, 2025).

To reduce it, the definitive elimination of the Tax on the Value of Electricity Production should be considered, which could lower the price by between €3 and €6/MWh in 2030. It would also be advisable to study the extension of the reduction of the Special Tax on Electricity, currently limited to companies whose electricity consumption represents at least 5% of the value of their production, to include industries with accredited commitments to energy efficiency.

The 80% reduction in network charges for energy-intensive consumers is temporary, and the compensation for indirect CO_2 is annual and lower than in other Member States. Therefore, greater stability in network charge reductions and more predictable financing could be considered. It would also be advisable to study the progressive strengthening of compensation within the European framework and its evolution towards a multi-year horizon linked to EU ETS revenues.

The review of balancing services and technical constraints could begin by identifying costs that can be reduced through more efficient management. Before redistributing the remaining funds, their impact on each type of consumer should be assessed to prevent them from falling disproportionately on households and SMEs, considering, where necessary, the use of budgetary funding.

It would also be advisable to establish a regular exchange of information between companies, industry associations, administrations, regulators and network managers regarding the location, maturity, schedule, power and consumption profile of the projects. Grouping them by industrial clusters would allow for differentiating firm needs from future forecasts, prioritizing reinforcements, and coordinating electrical investments with industrial deadlines. Planning should also integrate renewable hydrogen, prioritizing it as a raw material or in processes without sufficient direct electrification alternatives, and shared CO_2 infrastructures for emissions that are difficult to reduce.

This transformation must be developed gradually:

SHORT TERM	It would be advisable to study the reduction of fiscal and regulated components, greater stability of network charges and the strengthening of compensation for indirect CO_2.
MEDIUM TERM	It would be necessary to anticipate the networks, storage and shared infrastructures for electricity, hydrogen and CO_2.
LONG TERM	The goal would be to move towards an energy system integrated with industry that provides competitive, flexible and accessible renewable energy.

5.1.1.2 Permits, regulatory stability and administrative simplification

The duration and predictability of administrative procedures condition decarbonization projects. Electrification, renewable hydrogen, chemical recycling

or CCUS projects require simultaneous processing of environmental, industrial, energy and urban planning authorizations.

The length of permitting procedures and the complexity of aid schemes can delay technologically viable projects and divert resources from innovation towards administrative tasks. Furthermore, projects may evolve before the aid award decision and be subject to execution deadlines insufficient to complete their development and justification.

To expedite the process, it would be advisable to improve coordination between the competent bodies, clarify documentary requirements, reduce duplication, and facilitate joint management of authorizations. The Net-Zero Industry Act provides a reference through single points of contact and maximum deadlines, while the proposed Industrial Accelerator Act aims to extend this logic to industrial projects and energy-intensive sectors through the principle of "one project, one procedure" and a single digital procedure.

Administrative simplification should be accompanied by regulatory stability. Companies need to anticipate the evolution of energy costs, the price of carbon, subsidies and certification criteria over periods compatible with the amortisation of their investments. To reinforce this predictability, consideration could be given to publishing regulatory timetables and interpretative guidelines, establishing sufficient transitional periods, and conducting a prior assessment of the interactions between European, national, and regional regulations.

It would also be advisable to simplify public aid through standardized forms, technical assistance, clear compatibility criteria, and predictable timelines. Their execution timelines should be adapted to the actual phases of engineering, permits, contracting and final investment decision.

The implementation of this measure should be carried out progressively:

SHORT TERM	Mechanisms for prior dialogue, points of contact, coordinated digital files, and clear regulatory criteria must be implemented.
MEDIUM TERM	It will be necessary to harmonize procedures between administrations, strengthen their technical capabilities and adapt calls for proposals to industrial timelines.
LONG TERM	The goal will be to have a specialized, coordinated and stable administration, capable of processing complex industrial projects in a predictable manner without reducing regulatory guarantees.

5.1.1.3 Financing, carbon contracts for difference and the financial system

The decarbonization of the Spanish chemical industry will require an estimated cumulative investment of €65 billion until 2050, including equipment, facility modifications, plant shutdowns and regulatory adaptation. The challenge is not only to mobilize these resources, but to turn them into effective investments and prevent emissions reductions from occurring through a loss of productive capacity.

Public aid alone does not guarantee the financial viability of projects, which also depends on operating costs, energy volatility, technological maturity, infrastructure, and the demand for low-carbon products. Furthermore, each action presents different risks. Energy efficiency offers more predictable returns; electrification and hydrogen depend especially on energy costs; CCUS depends on still insufficient infrastructure; and chemical recycling depends on the market, traceability, and regulatory recognition.

Therefore, it would be advisable to select the instruments according to the risk of each project. CAPEX support could be used in the face of high initial costs; OPEX coverage, when the main obstacle is operating costs; and guarantees, to reduce financial or technological risks. Aid for shared infrastructure could complement projects dependent on electricity networks or the transport and storage of hydrogen and CO_2.

This combination could be structured from the early stages through a financial stack that integrates, where appropriate, Energy Saving Certificates, resources linked to the EU ETS, the future deployment of FIDI, other national and European instruments and private financing. The experience gained with the now completed PERTE Industrial Decarbonization program could be used to improve the design and coordination of these mechanisms.

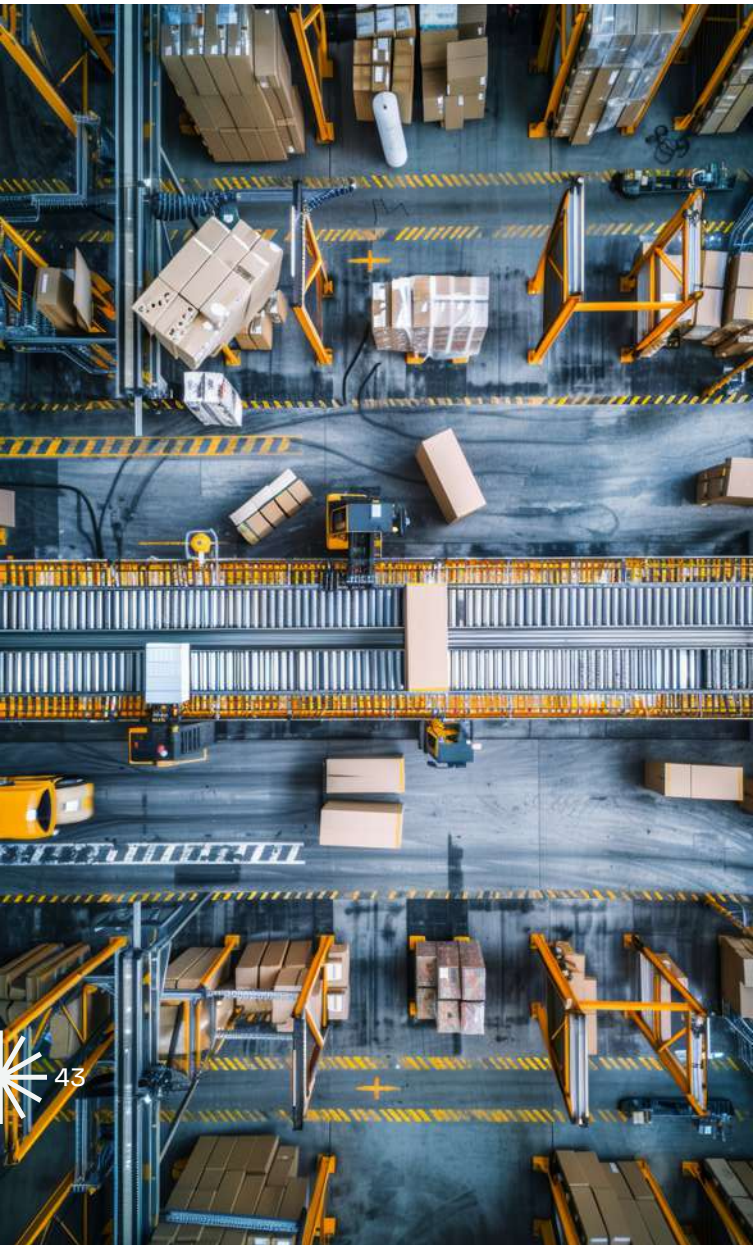
Carbon contracts for difference (CCfD) could prove particularly useful when investment aid does not offset the higher cost of operating decarbonized technologies. These contracts temporarily cover part of the difference between the abatement cost and the market signal, providing predictability and facilitating financing.

The Fund for the Promotion of Industrial Decarbonization (FIDI), created by Royal Decree-Law 7/2026, plans to support low-emission industrial investments, mainly through CCfD. Its regulatory development, subject to public consultation in July 2026, should specify the characteristics of the mechanism, its managing agent and the award procedure. The use of auctions could be considered to direct resources towards projects that achieve the greatest emission reductions at the lowest public cost.

It would also be advisable to develop specific evaluation methodologies, standardized contracts, and technical capabilities in banks and investors. Publishing aggregated data on costs, performance, and emissions reductions of supported projects would reduce perceived risk, improve financing conditions, and attract new capital profiles.

This transformation must be developed gradually:

SHORT TERM	The priority will be to identify the risk of each project, design the combination of instruments, and prepare bankable projects suitable for future CCfDs.
MEDIUM TERM	The accumulated experience will allow for the standardisation of methodologies, a reduction in perceived risk, and the attraction of new investment profiles.
LONG TERM	The goal will be to have a specialized financial system capable of financing industrial decarbonization under competitive conditions.



5.1.1.4 Measurement, market surveillance, standardization and territorial governance

The credibility of decarbonizing the chemical industry depends on the ability to measure, verify, and compare emission reductions and the environmental attributes of products. Without common methodologies, it is difficult to differentiate technological advances from reductions associated with production declines, to translate climate value into market value, and to ensure balanced competition.

A sectoral measurement, reporting and verification (MRV) system could start from the EU ETS methodologies for facility emissions and progressively extend to the product footprint and the value chain. Implementing Regulation (EU) 2018/2066 provides a basis for monitoring and reporting, which should be supplemented with criteria adapted to the diversity of processes, products and raw materials in the chemical industry.

To develop this system, a stable technical group could be formed, consisting of administrations, industry, accreditation and standardization entities, technology centers and independent experts. This group could agree on the system boundaries, baselines, emission factors, data sources, and attribution and verification rules. Methodologies should differentiate between subsectors and between emissions reduced, captured, reused and stored, avoiding double counting between facilities and products.

Before linking the MRV to financial instruments, it would be advisable to validate it through pilot projects that allow the development of sectoral guidelines and reference databases. In addition, consideration should be given to strengthening market surveillance

and customs controls on declarations of recycled or renewable content, carbon footprint and origin of raw materials, through risk-based controls, information exchange and audits of certifications.

This architecture could be complemented by stable governance spaces in the main chemical hubs. Administrations, companies, unions, technology centers, environmental organizations and local entities should participate from the early stages to coordinate infrastructure, anticipate impacts and periodically share information on emissions, safety, employment, investment and environmental performance. This approach is consistent with the Draft Law on Industry and Strategic Autonomy, which aims to modernize industrial areas and promote professionalized governance systems based on public-private collaboration and territorial consensus.

The evolution towards these new procedures must occur gradually:

SHORT TERM	Priority MRV methodologies must be agreed upon, market surveillance must be strengthened, and sectoral pilot projects and territorial spaces for dialogue must be launched.
MEDIUM TERM	It will be necessary to harmonize standards, connect traceability with financial and demand instruments, and deploy interoperable digital systems.
LONG TERM	The objective will be to have an integrated European system of measurement, certification, monitoring and transparency that allows recognition of the environmental value of chemical products and sustains their industrial and territorial legitimacy.

5.1.2 Technologies and decarbonization

The decarbonization of the chemical industry cannot rely on a single technological solution. The heterogeneity of processes, temperatures, raw materials and emissions requires combining energy efficiency, electrification, renewable hydrogen, circularity, chemical recycling, secondary raw materials and, in certain processes, carbon capture and utilisation or storage solutions.

The roadmap adopts a progressive logic. In the short term, priority is given to mature solutions and the validation of emerging technologies. In the medium term, the goal is to scale up those technologies that have demonstrated technical, economic and regulatory viability. In the long term, the aim is to consolidate circular and climate-neutral industrial processes.

5.1.2.1 Energy efficiency and process electrification

Energy efficiency and electrification are complementary actions to reduce the consumption of fossil fuels, emissions and the exposure of the chemical industry to energy volatility. Efficiency offers more immediate results with less technological risk, while electrification allows for a deeper transformation when suitable technical and economic conditions exist.

As a starting point, it would be advisable to carry out energy audits for each facility to identify losses, avoidable consumption, possibilities for heat recovery and operational improvements. These diagnoses would allow projects to be ranked according to their cost, savings, payback period, and contribution to subsequent investments. Digitisation, monitoring, equipment optimisation and heat recovery could be prioritised when they allow for a rapid reduction in demand. The Energy Saving Certificates System (CAE), regulated by Royal Decree 36/2023, also offers a way to monetize verified final energy savings and partially finance these actions.

Efficiency should also be considered a preliminary step to electrification. Reducing demand first allows for better sizing of electrical equipment, limiting the necessary power and decreasing the cost of the investment. This sequence follows the principle of "energy efficiency first" set out in Directive (EU) 2023/1791 and avoids electrifying consumption that could previously be eliminated.

Subsequently, the electrification of each process could be evaluated taking into account its temperature, pressure, continuity of demand, available space, power required and compatibility with existing facilities. According to Fraunhofer ISI, up to 90% of European industrial demand that is not yet electrified has the technical potential for direct electrification. However, its economic viability will depend on the price of electricity, network capacity, plant adaptations, and downtime.

To scale up the proven solutions, it would be advisable to promote pilot projects, strengthen networks and incorporate tools such as thermal storage and Heat Purchase Agreements (HPA). This approach aligns with the European Commission's Electrification Action Plan, which aims for electricity to account for 32% of final energy consumption by 2030 and sets an indicative target of 46% by 2040.

This transformation must be developed gradually:

SHORT TERM	Efficiency measures should be prioritized, CAEs should be leveraged, and the processes with the greatest viability for electrification should be identified.
MEDIUM TERM	It will be necessary to scale up proven solutions and strengthen networks, storage and energy supply models.
LONG TERM	The goal will be to have widely electrified, flexible and coordinated processes with a renewable, digitized and competitive electricity system, which will allow consumption to be shifted towards periods of lower price and greater renewable generation.

5.1.2.2 Renewable hydrogen and decarbonization of non-electrifiable processes

Renewable hydrogen can play a strategic role in the chemical industry, where it is used as an energy carrier, raw material, and, in some processes, a by-product. Its deployment should prioritise replacing fossil hydrogen used in the production of ammonia and fertilizers, refining and certain petrochemical processes, as well as uses without technically and economically efficient direct electrification alternatives. This prioritization is necessary because the electricity-hydrogen-heat chain has an approximate efficiency of 30-40%, much lower than direct electrification.

Spain consumes nearly 0.5 million tonnes of hydrogen annually, almost all of fossil origin and concentrated in refining, fertilizers and basic chemicals. Therefore, it would be advisable to initially orient the market towards the progressive replacement of this existing demand before extending it to new uses.

The PNIEC 2023-2030 raised the electrolysis target to 12 GW by 2030, compared to the 4 GW of the 2020 Hydrogen Roadmap. Its development should keep pace with the competitiveness of the applications and with effective demand. To do this, it would be advisable to evaluate each plant by comparing hydrogen with electrification, biogas and other alternatives according to its cost per tonne of CO_2 avoided, technological maturity and necessary infrastructure. The price of electricity will be a determining factor, representing between 65% and 80% of the production cost of renewable hydrogen, so electrolyzers should be located where there is competitive electricity, grid capacity and stable industrial demand.

This deployment could be supported by coordinated signals of demand, certification, and financing. The European Action Plan for the Chemical Industry promotes renewable and low-carbon hydrogen, while the Spanish system of guarantees of origin and Royal Decree 611/2026 reinforce the recognition of certain RFNBOs consumed by the industry. Furthermore, auctions linked to the European Hydrogen Bank can support production for several years and provide predictability.

It is advisable to start with industrial hubs where production and consumption can develop together, sharing infrastructure and avoiding capacity without demand. The hydrogen valley (H_2 Valleys) projects, with approximately 2.3 GW of electrolysis and a minimum local consumption of 60%, offer a reference. Their subsequent connection to the Spanish Hydrogen Backbone Network and H2Med should be aligned with the actual evolution of demand.

In fertilizers, the replacement of fossil hydrogen could be integrated into a decarbonization strategy and strategic autonomy. The European Action Plan on Fertilizers, approved in May 2026, aims to expand European production capacity, diversify supplies and promote low-carbon, circular and bio-based fertilizers. Green ammonia could contribute to reducing emissions and external dependence, along with the reduction of N_2O in nitric acid plants and the reduction of emissions from the use of fertilizers through nitrification inhibitors, microorganisms, better agronomic practices and verifiable methodologies.

The evolution towards this model must occur gradually:

SHORT TERM	The priority will be to identify priority uses, progressively replace fossil hydrogen and extend mature N_2O abatement solutions.
MEDIUM TERM	it will be necessary to scale up production in areas with proven demand and develop infrastructure, certification and supply contracts.
LONG TERM	The goal will be to have competitive renewable hydrogen supply chains for processes where there are no more efficient decarbonization alternatives.



5.1.2.3 CCUS pilots, standardisation and deployment

The chemical industry has potential to use captured CO_2 as a raw material in products such as methanol, polyurethanes and other derivatives, reducing dependence on fossil resources. However, CCUS should focus on process emissions and high-temperature applications that are difficult to reduce through energy efficiency, electrification, or renewable hydrogen.

In a first phase, it would be advisable to develop pilot projects that validate the entire chain and provide information on the costs of capture, transport and storage, as well as on measurement, safety and environmental impact. These projects could be accompanied by common guidelines, methodologies and standards promoted by the specific national committee on CCUS, subsequently facilitating the development of specific standards.

The European framework is moving in this direction. The European Strategy for Industrial Carbon Management proposes developing a single market for CO_2 transport and storage; the Net-Zero Industry Act sets a minimum injection capacity of 50 million tonnes per year by 2030; and the European Action Plan for the Chemical Industry plans to strengthen CCUS regulation and infrastructure.

In Spain, Law 40/2010 regulates the geological storage of CO_2 and the Draft Law on Industry and Strategic Autonomy contemplates supporting CCUS for emissions that are difficult to reduce when there are no other alternatives. To facilitate its scaling up, it would be advisable to progressively update the national framework, connect facilities, transport networks and storage facilities and clarify the conditions of access, authorization and responsibility.

Further progress could also be made in identifying clusters by mapping emission sources, volumes, distances and potential storage or utilisation locations. This information would allow for the selection of viable projects and the development of shared infrastructures that reduce costs. To use CO_2 as a chemical raw material, it would also be advisable to clarify its regulatory treatment, an issue included in the review of the EU ETS announced by the European Commission in July 2026.

The deployment should be accompanied by territorial information and dialogue on safety and environmental impacts, maintaining CCUS as a complementary solution for emissions that cannot be reduced by any other more efficient and environmentally friendly alternative.

With this in mind, the deployment of CCUS should take place gradually:

SHORT TERM	The priority will be to develop pilot projects, advance standardization, characterize potential emitters and storage facilities, and promote information and territorial dialogue processes on safety and environmental impacts.
MEDIUM TERM	It will be necessary to connect viable projects through shared infrastructure and consolidate a specific regulatory and financial framework.
LONG TERM	The goal will be to have CCUS chains integrated into the main industrial hubs and progressively connected to the future European CO_2 market.

5.1.2.4 Chemical recycling, secondary raw materials and circular processes

Circularity in the chemical industry requires combining different technologies. Mechanical recycling should maintain its priority when it is technically and environmentally appropriate, while chemical recycling could complement it in complex, contaminated or higher quality waste, such as certain mixed plastics and end-of-life tyres.

In the first phase, it would be advisable to promote pilot projects that compare performance, costs, energy consumption and product quality. The technology should be selected according to the composition and contamination of each waste and the characteristics of the material to be recovered. Possible solutions include pyrolysis for certain mixed plastics and tyres, gasification to obtain intermediate products such as methanol, and solvolysis to recover monomers or oligomers of PET, polyurethanes, or polyamides.

Its scaling will require clear rules for traceability and mass balance. Implementing Decision (EU) 2026/1425 constitutes an important step in recognizing chemical recycling and mass balance for accounting for recycled content. However, having been designed for the specific objectives of PET bottles in the Single-Use Plastics Directive, it will require adaptations to its allocation, traceability and verification rules for its application to all packaging (PPWR), automotive plastics (ELVR), and others.

This approach aligns with the European Action Plan for the Chemical Industry, which recognizes chemical recycling as a way to reduce dependence on fossil raw materials and move towards a European market for waste and secondary raw materials. In Spain, the Second Circular Economy Action Plan, approved in 2026, aims to increase the use of these raw materials, promote ecodesign and develop new recycling technologies.

Scaling should focus on solutions that demonstrate viability and have stable supply chains. To this end, agreements could be promoted between waste managers, recyclers and chemical companies to ensure their classification, treatment and supply. It would also be advisable to progressively incorporate waste, by-products, recovered CO_2, used oils, biomethane and sustainable biomass, considering their availability, sustainability and competition with other uses.

This process could be facilitated by streamlining the declaration of end of waste status and improving territorial coordination, to prevent administrative fragmentation from limiting the circulation and use of materials. Furthermore, the use of biomass, biogas or biomethane should be subject to sustainability criteria that consider its availability, competition with other uses and territorial impacts, avoiding transferring environmental pressures to other parts of the chain.

The evolution towards this model must occur gradually:

SHORT TERM	The priority will be to validate technologies, consolidate traceability, and expedite the use of waste and by-products as raw materials.
MEDIUM TERM	It will be necessary to scale up viable solutions and ensure stable supply chains of secondary raw materials.
LONG TERM	The goal will be to have increasingly circular chemical processes, with less dependence on fossil carbon, greater integration of secondary raw materials, products designed for recyclability, and a structural reduction of waste destined for landfill.

5.1.3 Demand and market

The industrial transformation requires that low-carbon, renewable or circular products find sufficient demand to offset, at least partially, the higher costs

associated with their production. The availability of technologies and financing does not guarantee the viability of projects if the market does not recognize their environmental attributes or if the additional cost is concentrated in the first links of the value chain.

The roadmap proposes an evolution from initial signals of demand and confidence mechanisms in the short term towards lead markets and circular consumption models in the medium term. In the long term, the goal is for the value of carbon and circularity to be fully incorporated into market decisions.

5.1.3.1 Green Public Procurement, labelling, certification and traceability

Green Public Procurement can act as a driving force to generate early demand for low-carbon or circular chemicals and reduce the uncertainty of initial investments. Its potential is significant, since public procurement in Spain represents around 11.5% of GDP and 25% of public spending.

To take advantage of this capacity, it would be advisable to establish simple, comparable and verifiable criteria, based on common methodologies and, where appropriate, on life cycle assessment (LCA). The future Green Public Procurement Plan 2026-2033, which was submitted to public consultation in July 2026, could promote a more systematic and homogeneous application of these criteria.

Green Public Procurement should also be supported by robust certification, labelling and traceability systems that verify the origin of raw materials, recycled or renewable content and emissions reduction. Regulation (EU) 2024/1781 on ecodesign provides a basis for moving forward in this direction through the Digital Product Passport and future mandatory green public procurement requirements.

This architecture will allow the same criteria to be extended to private contracting, imports and other demand creation instruments, although this adaptation will have to be carried out gradually:

SHORT TERM	The priority will be to consolidate methodologies, certifications and traceability systems and progressively incorporate them into public procurement.
MEDIUM TERM	It will be necessary to extend the validated criteria to a greater number of products and buyers and connect them with other demand creation instruments.
LONG TERM	The objective will be to have European lead markets capable of generating a stable demand for low-carbon and circular chemical products, guaranteeing equivalent criteria for European and imported products, in line with the Industrial Accelerator Act.

5.1.3.2 Mandatory quotas, recycled content and European lead markets

The roadmap proposes to assess the introduction of progressive quotas or requirements for recycled content when there is a sufficient technical basis, availability of material and adequate traceability systems. Its application could be carried out gradually and by product families, taking into account technological maturity, safety and the ability to verify the incorporated content. Given the lack of a homogeneous position in the sector, it would be advisable to start with limited areas and periodically review their results.

The European framework is already moving in this direction. The Communication on Sustainable Carbon Cycles sets as a benchmark that, by 2030, at least 20% of the carbon used in chemicals and plastics should come from sustainable non-fossil sources. Furthermore, Regulation (EU) 2025/40 on packaging and packaging waste, generally applicable from August 2026, establishes minimum recycled plastic content of between 10% and 35% by 2030, depending on the type of packaging.

These requirements should be aligned with the availability of secondary raw materials and the development of robust traceability and mass balance systems. Otherwise, they could raise costs, create new dependencies on imports, or hinder compliance. Therefore, it would be advisable to establish predictable schedules and review clauses in the event of possible technical, health or supply restrictions, as well as to coordinate their implementation with the progress of mechanical and chemical recycling.

On this basis, progress could be made towards European lead markets that bring visibility to the demand for low-carbon and circular chemical products. The Industrial Accelerator Act proposal, presented by the European Commission in March 2026, includes demand-side measures for European-made chemicals produced from sustainable carbon sources, such as biomass, waste and captured CO_2, as well as systems to classify their carbon intensity.

These markets could combine quotas, public procurement, purchasing agreements, and common sustainability criteria. A European approach would help avoid divergent national initiatives, connect

supply, demand and financing, and provide the necessary scale for new industrial investments.

With this in mind, the evolution towards this model should occur gradually:

SHORT TERM	The priority will be to consolidate certification, traceability and the availability of secondary raw materials.
MEDIUM TERM	It will be necessary to progressively implement recycled content requirements and develop lead markets for low-carbon and circular products.
LONG TERM	The goal will be to have a stable and harmonized European demand that allows for scaling up circular production and structurally reducing dependence on fossil raw materials.

5.1.3.3 Circular consumption, reuse and internalisation of carbon value

The transformation of the market should go beyond recycling and incorporate waste prevention, ecodesign and reuse to reduce the consumption of raw materials and treated materials at the end of their useful life. The Ecodesign for Sustainable Products Regulation provides a framework for introducing durability, reparability and circularity requirements, while the Packaging and Packaging Waste Regulation sets reuse targets for certain categories, such as 40% of transport packaging by 2030.

Reuse could be developed gradually, starting with products and supply chains where it is possible to implement safe and competitive systems for collection, return, cleaning and reconditioning. In single-use products, it would be advisable to differentiate between essential, replaceable and dispensable uses, considering the availability of alternatives and their health, industrial or safety functions.

At the same time, it would be advisable to move forward with internalizing the value of carbon, so that the lower emissions of a product translate into a verifiable economic advantage. To achieve this, harmonized product footprint methodologies could be consolidated and connected with public and private procurement, labelling, certification, and other demand creation instruments.

The evolution towards this model must occur gradually:

SHORT TERM	The priority will be to develop reuse models and identify products where they are technically and environmentally viable.
MEDIUM TERM	It will be necessary to extend these models and consolidate comparable methodologies for footprint, certification, and traceability.
LONG TERM	The goal will be for circularity and emissions reduction to be reflected in prices, procurement, and product regulation, generating stable demand for more sustainable chemicals.

5.1.4 Competitiveness and strategic autonomy

The decarbonization of the chemical industry must translate into productive transformation and not into a loss of industrial capacity. The risk that additional costs, asymmetric international competition, or technological dependencies will lead to plant closures or the substitution of European production by imports is one of the main concerns identified during the process.

The roadmap combines short-term competitive protection measures with the strengthening of European supply chains, production capacities and technologies in the medium term. In the long term, the objective is to consolidate a European strategic industrial autonomy compatible with trade openness and integration into global value chains.

5.1.4.1 ETS, CBAM and protection against unfair competition

The EU ETS and the Carbon Border Adjustment Mechanism (CBAM) should evolve in a coordinated manner to prevent increased European climate ambition from creating a structural disadvantage for industrial production, especially as the free allocation of emission allowances decreases.

In July 2026, the European Commission proposed a revision of the EU ETS that updates the free allocation rules and their relationship with the CBAM, strengthens protection against residual carbon leakage risks and increases support for industrial decarbonization,



including the future Industrial Decarbonization Bank. As it is still a proposal, its configuration will depend on the outcome of inter-institutional negotiations.

It would be advisable to maintain specific mechanisms to address the indirect costs of carbon. The amendment to the ETS State aid guidelines, adopted in December 2025 in line with the EU Chemicals Industry Action Plan, broadened the eligible sectors — incorporating various chemical industry activities, such as the manufacture of other organic basic chemicals and the manufacture of plastics in primary forms, among others — and the compensation possibilities for energy-intensive industries exposed to carbon leakage.

The application of these instruments could be supported by monitoring by products and subsectors that compares the carbon costs borne in Europe, the evolution of imports and possible shifts in production or investment. This analysis would allow for the detection of insufficient protection and provide a basis for future reviews of the CBAM or compensation mechanisms.

It would also be advisable to strengthen the verification of emissions incorporated in imports through comparable documentation, certification, and risk-based customs controls. Although the final CBAM regime already establishes authorization, declaration and verification obligations, its effectiveness will depend on having sufficient technical capabilities to detect incorrect declarations and possible evasive practices.

Therefore, the evolution towards this model must occur gradually:

SHORT TERM	The priority will be to ensure effective implementation of CBAM, strengthen surveillance, and maintain adequate protection against indirect costs.
MEDIUM TERM	It will be necessary to adjust the coordination between ETS and CBAM as the reduction of free allowances progresses and to increase their effectiveness against potential carbon leakage.
LONG TERM	The goal will be to have a European framework that combines an effective carbon signal with the transformation and permanence of a competitive chemical industry.

5.1.4.2 Strengthening and diversifying supply chains and European strategic autonomy

The chemical industry depends on energy, raw materials, technologies and logistics corridors exposed to increasing geopolitical tensions. To strengthen its resilience, it would be advisable to identify the critical products and capabilities for both the sector and the industries it supplies, considering the concentration of suppliers, the available alternatives, replenishment times and the impact of possible disruptions.

As a starting point, dependency and risk maps could be developed that integrate information on suppliers, European production capacity, inventories, logistics routes and supply alternatives. These maps would allow us to anticipate bottlenecks, differentiate between temporary vulnerabilities and structural dependencies, and guide investments. This approach aligns with the objectives of the Critical Chemicals Alliance, which aims to identify critical chemical molecules and capabilities and coordinate European and national investment priorities.

Based on this analysis, it would be advisable to diversify suppliers and routes through longer-term supply contracts, alternative sources, strategic

inventories, and greater use of secondary raw materials available in Europe. This diversification should be accompanied by the preservation of strategic production capacities, especially given the approximate loss of 15% of European steam cracking capacity and 9% of ammonia production compared to 2021.

In Spain, the role of the Strategic Reserve based on National Industrial Production Capabilities (RECAPI), foreseen in the Draft Law on Industry and Strategic Autonomy, could be considered to identify and preserve productive capacities of a strategic nature.

The objective would be to strengthen European strategic industrial autonomy, understood as the ability to maintain value chains in the face of disruptions through a combination of European production in critical areas, diversification of supplies, circularity and international alliances.

This transformation must be developed gradually:

SHORT TERM	The priority will be to identify critical dependencies, products, and capabilities and strengthen their monitoring.
MEDIUM TERM	It will be necessary to diversify suppliers and routes and preserve the production capacities considered strategic.
LONG TERM	The goal will be to have diversified and resilient supply chains and sufficient capabilities to strengthen the strategic autonomy of the European chemical industry.

5.1.4.3 European industrial capacities and technological production

The deployment of decarbonization technologies offers an opportunity to strengthen European industrial capabilities in areas such as electrolyzers, electrification equipment, thermal storage, recycling, carbon capture, digitalization and advanced control systems. The goal should be to prevent the transition from replacing fossil fuel dependencies with new external technological dependencies.

To achieve this, it will be necessary to identify existing production capacities, critical components and technological dependencies and to direct investments towards those segments where Europe has knowledge, industrial capacity or scaling potential. The Net-Zero Industry Act establishes as an indicative and non-binding reference that European manufacturing capacity for net-zero technologies should cover at least 40% of the EU's annual deployment needs by 2030. Together with the Industrial Accelerator Act, which seeks to promote low-carbon products and technologies manufactured in Europe through Made in Europe criteria and decarbonization in procurement and public aid, and the Clean Industrial Deal State Aid Framework (CISAF), it should facilitate the connection between European technological financing, demand and production.

The goal should not be to achieve complete technological self-sufficiency, but to preserve critical capabilities, diversify risks and maximise the industrial value generated in Europe. In this way, the aid granted must prioritise projects that combine innovation, production capacity, identified demand and contribution to European value chains.

This process must be accompanied by training and retraining plans linked to industrial hubs and actual investment schedules. Electrification, hydrogen, chemical recycling, CCUS and digitalisation will require new profiles, so it will be necessary to strengthen collaboration between companies, vocational training, universities, technology centres and trade union organizations.

This transformation must be developed gradually:

SHORT TERM	The priority will be to identify technological capabilities and dependencies and strengthen the segments with the greatest potential.
MEDIUM TERM	It will be necessary to scale up European manufacturing and adapt professional skills to new investments.
LONG TERM	The objective will be to have a diversified and competitive European technological base, capable of supplying the strategic technologies needed for industrial decarbonization.



06 Priority proposals

This section describes the actions that different stakeholder groups can take to accelerate decarbonization.

6.1 Promote Green Public Procurement as a demand creation tool

What does it consist of?

Decarbonizing the chemical industry requires not only developing low-carbon, circular products or products made with renewable or secondary raw materials but also generating a demand that recognizes their environmental value and allows for offsetting their higher cost. Without buyers willing to absorb this difference, the necessary investments will hardly be able to scale up.

Public procurement can help overcome this barrier. In Spain it represents approximately 11.5% of GDP and 25% of public spending, so its strategic use could provide initial commercial references, bring predictability to demand and favor the scaling up of new products. The Administration would act as both a leading buyer and a regulator and financier of the transition.

The legal framework already allows for the inclusion of environmental criteria in the different phases of contracting. The main challenge is to achieve a more systematic and homogeneous application. The Green Public Procurement Plan 2026-2033, the development of which began with a public consultation held from 14 to 31 July 2026, offers an opportunity to move forward in this direction. The new Plan will replace the one corresponding to the period 2018-2025 and will complement the Catalogue of Green Technical Specifications approved in 2025.

At European level, Directives 2014/23/EU, 2014/24/EU and 2014/25/EU allow for the incorporation of environmental, social and innovation considerations. The European Commission's new initiative to review this framework aims to simplify and digitize procedures, improve regulatory consistency and introduce *Made in Europe* criteria to strengthen economic security and resilience. It also seeks to align public procurement with environmental, social and innovation goals.

This review could harmonize the criteria applied by public buyers and expand the demand for sustainable industrial products. For the chemical industry, it would reduce the uncertainty associated with the environmental premium for low-carbon products and non-fossil raw materials, identified as a barrier by the EU Chemicals Industry Action Plan (2025).

The recommendation, therefore, is to take advantage of the new Spanish Plan and the European review to strengthen public procurement as an instrument for creating industrial demand. Initially, it would be advisable to concentrate it on categories with significant purchasing power, a sufficiently mature supply, and comparable and verifiable environmental attributes.



Aim

Consolidate a Green Public Procurement policy capable of:

- Generating a predictable **and verifiable public demand** for low-carbon, circular products, materials and end goods, or products made with renewable or secondary raw materials.
- Recognising the differential environmental **value** of these products through objective criteria linked to their performance and life cycle.
- Connecting **investment support instruments with demand generation mechanisms**, reducing the risk of financing new productive capacity without a sufficient market for the resulting products.
- Promoting industrial scaling **and progressive cost reduction**, providing greater visibility into the Administration's future needs.
- Using the power of public procurement **as a driving signal** for private markets, generating commercial references and facilitating the subsequent dissemination of environmental criteria to other value chains.
- Orienting Green Public Procurement towards **measurable environmental and industrial results**, preventing its application from being limited to the formal inclusion of clauses in procurement procedures.



Measures

Integration of demand creation into the Green Public Procurement Plan 2026-2033

- **Explicitly incorporate the creation of industrial demand** among the objectives of the new Plan, recognizing the capacity of public procurement to facilitate the scaling up of low-carbon, circular products made with secondary or renewable raw materials.
- Identify **priority procurement categories** taking into account purchase volume, environmental impact, maturity of supply, verification capacity and potential to mobilize industrial investment.
- Establish a **progressive trajectory for incorporating criteria**, differentiating between legal obligations, basic criteria and advanced levels, which can evolve towards minimum requirements when there is sufficient supply and verification capacity.

Leveraging the future Circular Economy Act to consolidate secondary raw material markets

- Promote during the processing of the future **Circular Economy Act** the use of **public procurement as an instrument for generating demand for circular products and secondary raw materials**, especially in those markets where there is recycling or recovery capacity that does not yet find sufficient demand.
- Promote **harmonized European criteria for recycled, renewable or bio-based content** for those **categories where there is sufficient availability, technological maturity and verification capacity**, avoiding the proliferation of incompatible national requirements that fragment the internal market.
- Promote the **progressive incorporation of minimum circularity requirements in European public procurement**, where market conditions allow, combining them with more ambitious award criteria that recognize superior performance.
- **Coordinate procurement criteria with the development of a single market for secondary raw materials**, so that policies aimed at increasing collection, recovery and recycling are accompanied by measures aimed at ensuring their effective reintegration into production processes.

- Develop **common methodologies for traceability and verification of recycled, renewable or bio-based content**, taking advantage of instruments such as the Digital Product Passport and avoiding double counting or incompatible national systems.

Development and expansion of the Catalogue of Green Technical Specifications

- **Incorporate criteria based on environmental performance and life cycle,** avoiding prescribing specific technologies when different solutions can achieve equivalent results.
- **Consider, depending on each category, parameters such as carbon footprint**, recycled or renewable content, resource efficiency, durability, reuse, recyclability, waste generation or presence of substances of concern.
- **Recognize equivalent labels, certifications, technical standards and means of proof**, avoiding requirements that may unjustifiably restrict competition.
- **Develop traceability systems for recycled, renewable or low carbon raw materials and methodologies adapted** to the particularities of chemical chains.
- **Periodically update the data sheets and criteria** to incorporate technological, regulatory and supply evolution.

Recognition of environmental value and the green premium

- **Incorporate from the contract planning stage the costs associated with higher environmental performance,** avoiding budgets that make compliance unfeasible.
- **Coordinate Green Public Procurement with subsidies, guarantees, contracts for difference or other instruments to support decarbonization**, preventing supply and demand policies from operating in a disconnected manner.

Training, technical assistance and verification

- **Strengthen the training of promoting units, contracting bodies and contract managers** in sustainability, life cycle, certification and traceability.
- **Develop reusable models of specifications, clauses and means of proof** that reduce administrative complexity and increase legal certainty.
- **Incorporate from the preparation of the contract a system for verifying environmental commitments**, defining responsible parties, controls and consequences of non-compliance.
- **Use the recurring difficulties detected** during execution to periodically update and improve the Catalogue.



Monitoring, transparency and evaluation

- Establish a **common methodology to identify and classify Green Public Procurement contracts**, avoiding considering as such those that only incorporate formal environmental references.
- **Also assess the effects on competition and participation of SMEs,** including number of bids, concentration of suppliers and unsuccessful tenders.
- **Publish an annual monitoring report that allows for periodic review of the Plan and the Catalogue** and progressively raising the ambition of the criteria as the market matures.



Actors involved

Ministry for Ecological Transition and the Demographic Challenge

- Coordinate the Green Public Procurement Plan 2026-2033 and the updating of the Catalogue, incorporating the creation of industrial demand, priority categories and progressive environmental criteria.
- Define common environmental methodologies and coordinate the annual monitoring of results to review the Plan and the Catalogue.

Ministry of Finance

- Ensure consistency with public procurement legislation and provide guidance, model tender documents and training on environmental criteria, equivalent means of proof and life cycle costs.
- Incorporate these criteria into centralized procurement, consider the costs of enhanced environmental benefits, and improve the classification, monitoring, and transparency of green procurement.

Ministry of Industry and Tourism

- Identify the value chains and product categories with the greatest potential to generate demand and mobilize investment, taking into account the available supply and the capacity for recycling and recovery.
- Coordinate public procurement with decarbonization support instruments and assess their effects on investment, technological scaling, productive capacity and SME participation.

Autonomous communities and local entities

- Apply common criteria in priority categories, develop pilot projects, and aggregate and schedule demand.
- Provide adequate budgets, strengthen procurement capabilities and verify environmental commitments, sharing results and difficulties to improve the Plan and the Catalogue.

CNMC, Independent Office for Regulation and Supervision of Procurement (OIReScon) and supervisory and appeal bodies

- Analyze, within their respective competencies, the legality and proportionality of the criteria, avoiding unjustified restrictions on competition and the participation of SMEs.
- Identify application barriers and assess market response, including offers received, supplier concentration, and unsuccessful tenders.

European Commission

- **DG GROW and DG ENV:** connect the European public procurement framework with industrial policy and the future Circular Economy Act, promoting harmonized criteria, progressive circularity requirements and secondary raw material markets.
- **DG CLIMA, DG COMP and DG TRADE:** ensure, within their respective areas, consistency with climate methodologies and competition, State aid and trade rules, including resilience requirements or European content where appropriate.

Standardization, accreditation, certification and verification bodies

- Develop comparable methodologies, standards, and testing methods on environmental performance, life cycle, and recycled, renewable, or bio-based content.
- Ensure reliable and compatible certifications and traceability systems, leveraging the Digital Product Passport and avoiding double counting and unsubstantiated environmental declarations.

Companies, sector associations, SMEs, technology centers and social agents

- Provide information on supply, production capacity, costs, technological evolution and barriers to participation through market consultations and pilot projects.
- Contribute to the development of means of verification and to the evaluation of environmental, industrial and social impacts, participating in the review of the Plan and the Catalogue.

Potential barriers

- Institutional and territorial fragmentation, which can produce different criteria between administrations and reduce predictability for suppliers.
- Increasing complexity of the regulatory framework, derived from the coexistence of environmental obligations, voluntary criteria and sectoral requirements from different administrative levels.
- Lack of technical training and specialised resources in the units responsible for preparing and supervising contracts.
- Lack of sufficiently mature methodologies, standards, or testing methods for certain categories of chemicals or materials.
- Mismatch between the level of demand and the maturity of the supply, which can lead to unsuccessful tenders or dependence on a small number of suppliers.
- Risk of reduced competition, when the accumulation of technical requirements, certifications or documentary burdens raises barriers to entry.
- Insufficient predictability and aggregation of demand, when purchases are made in a fragmented, occasional manner or without a sufficiently visible schedule for suppliers.
- Insufficient monitoring during the execution of contracts, which may cause the environmental commitments incorporated in the tender documents to not translate into verifiable results or to be reduced to formal award requirements.

6.2 Strengthen the effectiveness of the EU ETS and CBAM to protect industrial transformation

What does it consist of?

Decarbonizing the chemical industry requires that the price of carbon create an effective incentive to invest in processes and technologies with lower emissions, without causing emissions reductions within the European Union to occur through the loss of production, investment or market share compared to facilities located in jurisdictions with lower climate requirements.

The EU Emissions Trading System (EU ETS) is the main European instrument for putting a price on industrial emissions. The system establishes a decreasing limit on the total volume of emissions and obliges covered facilities to deliver annually one emission allowance for each tonne of CO_2 equivalent emitted, in accordance with the emissions generated during the year, declared in accordance with the monitoring rules of the EU ETS and subsequently verified. In this way, it generates a favorable economic signal for efficiency, energy substitution and the adoption of low-carbon technologies. The Carbon Border Adjustment Mechanism (CBAM) complements this system by progressively shifting to certain imports a carbon cost equivalent to that which a comparable product manufactured in the European Union would bear.

The EU ETS and the CBAM perform complementary functions, although their scope within the chemical industry is currently different. While the EU ETS structurally affects a significant portion of emissions-intensive chemical installations, the CBAM currently has a more limited application within the sector.

Based on this logic of complementarity, the final phase of CBAM began on 1 January 2026 and currently includes iron and steel, aluminium, cement, fertilizers, hydrogen and electricity, with a direct impact on the chemical industry, especially significant in fertilizers and hydrogen. Regulation (EU) 2023/956, which establishes the Carbon Border Adjustment Mechanism, also provides for evaluating a future extension of its scope to other products exposed to the risk of carbon leakage, expressly including organic chemicals and polymers.

Precisely because the CBAM is intended to progressively replace part of the protection against



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carbon leakage currently provided by the free allocation of the EU ETS, coordination between the two instruments is especially relevant. The current framework progressively reduces the free allowances allocated to producers of goods covered by the CBAM until its disappearance in 2034. However, on 17 July 2026, the Commission presented a proposal to revise the EU ETS, which proposes to slow down this timetable: instead of its complete elimination in 2034, it proposes to maintain 15% of the calculated free allocation for these products until 2037 and complete its withdrawal in 2038. The reform thus aims to extend the period for European industry to adapt to CBAM, while maintaining incentives to undertake decarbonization investments.

This review of the EU ETS is complemented by the process of strengthening and expanding the CBAM itself. The proposal presented by the Commission in December 2025 suggests extending the mechanism to certain processed products and strengthening the tools designed to prevent circumvention practices. The Council set its negotiating position in June 2026 and the European Parliament's Environment Committee adopted its own in July, with the dossier remaining pending completion of the legislative procedure. Also under consideration is the proposal for a Temporary Decarbonization Fund, designed to support investments in sectors subject to a residual risk of carbon leakage during the deployment of CBAM, especially in relation to their exposure to export markets. These reforms expand the tools available to protect industrial transformation, but leave open the challenge of ensuring that the removal of existing protections progresses at the same pace as the CBAM's effective capacity to prevent carbon leakage.

Therefore, it is recommended to take advantage of the review of the EU ETS and the evolution of the CBAM to consolidate a common framework that combines a demanding carbon signal with effective instruments for protection against carbon leakage and support for investment. The withdrawal of any transitional measures must be aligned with the actual effectiveness of the CBAM and with the conditions that allow for an effective transformation of European industry, in accordance with the requirements established by European regulations.

Furthermore, any potential expansion of the CBAM scope to new chemicals should be preceded by a proper assessment of its effects on European competitiveness, exports and value chains, in order to avoid negative indirect repercussions for the sector.

Aim

Consolidate the EU ETS and the CBAM as coordinated instruments capable of:

- **Maintaining a credible and predictable carbon signal** that incentivises emissions reduction and investment in technologies that will transform the European production base.
- **Aligning the phase-out of free allocation with the actual effectiveness of the CBAM**, avoiding gaps in protection against carbon leakage.
- **Preventing the reduction of territorial emissions from occurring through loss of industrial production** or substitution by more carbon-intensive imports.
- **Progressively correcting carbon leakage that can be transferred to other products**, links in the value chain or exports.
- **Coordinating the carbon price signal with industrial, energy, financial and demand**

generation policies, recognising that the EU ETS and CBAM cannot by themselves solve the set of barriers that condition industrial transformation.



Measures

Progressively expand protection against carbon leakage along value chains

- **Support the extension of CBAM to processed products where there is evidence that carbon leakage is shifting to later links in the chain,** preventing commodity protection from creating a disadvantage for their European industrial users.
- **Evaluate the future incorporation of organic chemicals and polymers**, provided for in Regulation (EU) 2023/956, when sufficient conditions exist for its application.
- Specifically analyze the exposure of European exports to markets that do not apply a comparable carbon cost and assess the development of instruments compatible with international trade rules when a proven risk of leakage persists. This reflection would take into account the evolution of the multilateral trading system and the challenges arising from the current international context.
- **Periodically review the sectoral coverage of the mechanism** to prevent the transformation of trade patterns from shifting carbon leakage towards products or activities not covered.

Use ETS revenues to accelerate decarbonization

- **Direct a sufficient part of the resources generated by the EU ETS towards industrial decarbonization investments,** prioritising projects capable of reducing process emissions, electrifying operations or replacing fossil raw materials.
- Coordinate the Innovation Fund, the future **Industrial Decarbonization Bank and the future Temporary Decarbonization Fund** with the **needs of sectors subject to high carbon exposure and international competition.**
- **Develop carbon contracts for difference or other equivalent instruments** for projects where the expected evolution of the allowance price does not by itself provide a sufficient signal to undertake the investment.

Strengthen the international dimension of CBAM

- **Support the development of measurement, reporting, verification and accreditation capacities in third countries.**
- Ensure that **the CBAM design adequately recognises the price of carbon effectively** paid in the countries of origin, avoiding double taxation and at the same time preserving the environmental integrity of the mechanism.
- **Strengthen dialogue with key trading partners on the evolution of the CBAM**, its methodologies and the treatment of third-country carbon pricing systems.
- **Support greater international convergence of carbon pricing systems**, progressively reducing regulatory differences that create the risk of carbon leakage.
- **Promote cooperation mechanisms with third countries** that accompany their own industrial decarbonization, preventing the CBAM from being perceived exclusively as a trade protection instrument.



Actors involved

European Commission

- DG TAXUD, DG GROW and DG TRADE: assess the expansion and review of CBAM coverage, its effects on value chains and exports, and strengthen its international dimension through dialogue, cooperation and recognition of the carbon price effectively paid in third countries.
- DG CLIMA and DG COMP: coordinate the targeting of ETS revenues and European financing instruments towards industrial decarbonization, including carbon contracts for difference, ensuring their compatibility with competition and state aid rules.

European Parliament and Council of the European Union

- Negotiate and approve reforms to the EU ETS and CBAM, incorporating a progressive expansion of protection against carbon leakage when sufficient evidence, methodologies and enforcement capabilities exist.

Ministry for Ecological Transition and the Demographic Challenge

- Define and defend a coordinated Spanish position on the evolution of the EU ETS and the CBAM, their coverage and international cooperation on carbon pricing.
- Coordinate the application of the EU ETS with financing instruments, directing resources towards verifiable decarbonization investments and evaluating their results.

Ministry of Industry and Tourism

- Identify and convey to European negotiations the impacts of the EU ETS and the CBAM on Spanish competitiveness, exports and industrial value chains.
- Coordinate industrial policy and financing instruments with the transformation needs of the sectors most exposed to carbon and international competition.

Companies and industrial associations

- Provide information on trade exposure, transformation costs, technological availability and carbon leakage risks along value chains.
- Participate in the consultations and reviews of the EU ETS and the CBAM, contributing to identifying funding needs and conditions to expand the coverage of the mechanism.

Trade unions, environmental organizations, and research centers

- Evaluate the effects of the measures on employment, territories, global emissions and competition, contributing to the monitoring of their results.



Potential barriers

- Regulatory uncertainty arising from the review of the EU ETS and the amendments to the CBAM currently under negotiation.
- Mismatch between the phase-out of free allocation and the actual effectiveness of the CBAM, which may generate periods of insufficient protection or, conversely, overcompensation.
- Persistence of leakage risks associated with European exports to markets without a comparable carbon price.
- High energy, capital and operating costs, which the carbon price and CBAM cannot correct on their own.
- Complexity of chemical chains to attribute emissions to specific products and differentiate raw materials, precursors and processes.
- Uneven quality and availability of emissions data from third countries and limited verification capacity.
- Risk of avoidance, reclassification or artificial modification of trade flows as the cost associated with CBAM increases.

6.3 Strengthen market surveillance and customs controls



What does it consist of?

The transformation of the European chemical industry requires that imported products entering the internal market effectively comply with the obligations applicable to them in the European Union. When European companies bear the costs arising from environmental, chemical or climate requirements that are not adequately controlled in imported products, competitive asymmetries can arise that penalise compliant companies and reduce the effectiveness of the decarbonization policies being implemented within the Union.

To avoid this asymmetry, market surveillance and customs controls play a crucial role. Customs authorities operate at the Union's external border, using available information on goods and operators to determine which shipments require additional checks before entering the EU. Market surveillance, for its part, makes it possible to verify that products already marketed in European territory comply with the requirements through documentary, physical or laboratory controls and to adopt, where appropriate, corrective measures against non-compliant products. Regulation (EU) 2019/1020 establishes the general European framework to strengthen this surveillance and improve cooperation between authorities.

This framework is currently under review in the context of the future European Product Act, which will modernize and strengthen European rules on market surveillance and product conformity, improve coordination between authorities and respond more effectively to non-compliance associated with imported products. Its development offers an opportunity to consolidate a more coordinated European governance of enforcement and a better connection between market surveillance authorities and customs authorities.

This cooperation should be complemented by a strengthened European governance of market surveillance that systematically supports national authorities, allows the sharing of capabilities and technical knowledge and coordinates actions in the face of persistent or European-dimension infringements, respecting the competences of the Member States.

The main challenge lies not only in the existence of rules, but also in having sufficient capabilities to verify compliance. The increasing volume and complexity of products entering the European market make it advisable to assess and, where necessary, strengthen the human resources, training and technological means of the competent authorities, including customs authorities.

In addition to the available resources, the regulations must be designed in a way that allows for monitoring and verifying compliance with obligations. To achieve this, it must clearly define responsibilities, guarantee access to data, establish appropriate methods of analysis and document review, and ensure sufficient laboratory capacity.

For the chemical industry, this control capacity is especially relevant due to the complexity of the obligations arising from regulations such as REACH and CLP and the increasing integration of international supply chains. The results of the European project REF-12, published by the European Chemicals Agency (ECHA) in December 2025, revealed significant compliance problems in controls specifically aimed at imports: approximately one third of the substances contained in mixtures examined lacked the required REACH registration and products that did not comply with European restrictions on hazardous substances were also detected. The problem is so significant that the ECHA Forum for Exchange of Information on Enforcement itself has placed import controls among its priorities for 2026-2027.

It is also common for products and plastic packaging to enter the country claiming recycled content without it being possible to properly verify whether they come from secondary material or virgin plastic. The chemical formula can be identical regardless of the origin of the material, so there is no simple analytical test that allows it to be determined at the border. This difficulty will become more relevant with the introduction of minimum recycled content requirements, such as those planned for end-of-life vehicles.

Therefore, it would be advisable to determine which checks should be carried out before importation through documentation, certifications and traceability systems, and which ones correspond to customs or subsequent market surveillance. When the origin cannot be determined analytically, control should be based on a verifiable documentary chain, complemented by audits and risk-based controls.

This concern has also acquired an important industrial dimension. The EU Chemicals Industry Action Plan (2025) states that imported products must comply with the same standards applicable to products marketed in the Union and identifies the strengthening of market surveillance and customs controls as a tool to prevent non-compliant imports from distorting competition. In this regard, the Plan aims to strengthen the monitoring of chemical imports and leverage digital tools, including the Digital Product Passport where applicable, to improve the information available throughout the value chains.

The reform of the European Customs Union opens up an additional opportunity to move forward in this direction. Following the political agreement reached between the Council and the European Parliament in March 2026, the Council gave its final approval to the reform on 3 September 2026, pending formal approval by the European Parliament and subsequent publication of the regulation. The reform envisions the creation of a European Union Customs Authority and an EU Customs Data Centre, designed to strengthen joint analysis of information, harmonize risk management and concentrate controls on operators and goods most likely to be non-compliant. The new Authority will begin operating in 2027, while the Data Centre will be rolled out gradually, starting with e-commerce and later extending to all operators.

Therefore, the recommendation is to strengthen the human, training and technological capacities of the Ministry of Finance and Customs, as well as to take advantage of the European reinforcement of market surveillance, the definitive application of the CBAM and the reform of the Customs Union to develop a more coordinated control system, based on risk and supported by traceability and data exchange, capable of detecting non-compliant products and imports more effectively without introducing unnecessary burdens on operators who comply with the regulations. Its design should be developed in conjunction with DG TAXUD and clearly differentiate between pre-market, border, and post-market checks.



This system should be complemented by European support mechanisms, coordination and shared capacity for market surveillance, focused on areas of non-compliance of European dimension and on repeat offenders.

In particular, the future adoption and development of the European Product Act should be used as a vehicle to strengthen European governance of market surveillance and its operational connection with the reform of the Customs Union.

Aim

Consolidate a market surveillance and customs control system capable of:

- Ensuring that imported products effectively comply with applicable European obligations, avoiding competitive advantages arising from non-compliance or unverified environmental declarations.
- Strengthening coordination between customs, market surveillance authorities and authorities responsible for chemical and climate legislation, determining what checks should be carried out before importation, at the border or after marketing.
- Improving the availability, interoperability and utilization of data needed to detect non-compliance, inconsistencies and circumvention practices, including declarations about recycled content that cannot be verified by analytical techniques.
- Ensuring the correct application of the CBAM, verifying the necessary elements to determine the obligations of importers and preventing incorrect declarations from reducing the effectiveness of the mechanism.
- Promoting a more homogeneous application of controls throughout the European Union and among Spanish administrations, reducing differences that may generate points of entry or marketing with a lower level of supervision.
- Strengthening the human resources, training, and technological and laboratory capabilities necessary to effectively implement the controls.
- Taking advantage of the future European Product Act to modernise the market surveillance framework, strengthen its European governance, and improve cooperation on imported products.

Measures

Take advantage of the Customs Union reform and new digital tools

- Leverage the future EU Customs Authority and Customs Data Centre to **develop common risk profiles on chemicals and industrial materials, sharing information between Member States and reducing national differences** in the intensity of controls.

- **Promote interoperability between customs systems**, European market surveillance tools and relevant sectoral registers, avoiding duplication and enabling automated analysis of inconsistencies.
- **Use advanced data analysis techniques to identify anomalous changes in origin, classification, volumes, operators or trade routes** that may warrant additional controls.
- **Integrate progressively**, where applicable, the **information from the Digital Product Passport, certifications and other traceability systems**, facilitating the verification of the declared characteristics.
- When recycled origin cannot be analytically distinguished from virgin material, support control through traceability systems and documentary checks throughout the supply chain.

Strengthen coordination between market surveillance and customs controls

- **Establish stable mechanisms for the exchange of information between customs authorities, market surveillance authorities and those responsible for compliance with chemical regulations,** allowing incidents detected after marketing to be incorporated into the risk profiles used at the border and vice versa.
- **Develop common risk analysis criteria that take into account the product, operator, origin, compliance history, documentation provided and declared characteristics**, concentrating physical and documentary controls where there is a higher probability of non-compliance.
- **Strengthen coordinated import inspection campaigns**, especially in categories with a history of non-compliance, high competitive exposure or the presence of restricted substances, including certain products and packaging that declare recycled content.
- **Pay special attention to categories subject to minimum recycled content requirements** when there is no analytical technique that allows direct verification of the origin of the material.
- **Facilitate that non-conformities detected by an authority can trigger equivalent actions in other territories** or Member States when the same product is being marketed in different markets.

Strengthen the control and verification associated with CBAM

- **Ensure interoperability between the CBAM Registry and customs systems,** facilitating the verification of the declarant's status, the goods affected, their tariff classification, origin and imported quantities.
- **Strengthen the verification of emissions data used to calculate CBAM obligations**, favoring the use of real data when they are duly accredited and applying the default values provided for by the regulations when there is no verifiable information.
- **Establish clear procedures to verify the price of carbon actually paid in the country of origin**, ensuring that only costs actually incurred are deducted after considering possible refunds, compensations or free allocations.
- Develop, where necessary, practical guidelines to facilitate importers' compliance with the obligations set out in the CBAM regulations, defining the information they must obtain from their third-country suppliers, the guarantees necessary to support the declarations submitted, and avoiding introducing additional requirements or duplications with respect to the applicable legal framework.
- **Use customs and CBAM information together to identify possible practices of evasion**, reclassification of goods, artificial modification of trade chains or incorrect declaration of embodied emissions.

Harmonize and strengthen surveillance capabilities

- **Develop common training programs for customs personnel, inspectors and sector authorities,** particularly in chemical classification, REACH, CLP, CBAM and new sustainability obligations, including documentary verification of recycled content.
- **Evaluate the actual staffing needs of the Ministry of Finance, Customs and the market surveillance authorities** and progressively strengthen their staff and technological resources.
- **Strengthen the capacities of laboratories, technical bodies and accreditation entities** needed to support controls with sufficiently robust tests.

- **Promote homogeneous inspection protocols and common criteria on the actions to be taken in the face of non-conforming products**, reducing differences between territories and Member States.



Actors involved

European Commission

- **DG GROW:** coordinate market surveillance of industrial products, promote common campaigns and protocols and facilitate the exchange of information between national authorities and European systems.
- **DG TAXUD:** coordinate the development of common risk profiles and the interoperability of customs systems with surveillance tools and the CBAM Registry, promoting the Customs Data Centre and the analysis of possible non-compliance and avoidance practices.
- **DG CLIMA:** define methodologies and guidelines to verify embodied emissions and the carbon price effectively paid in the country of origin, ensuring consistency between the CBAM and the EU ETS.
- **DG ENV:** clarify applicable chemical and environmental requirements and promote common criteria for documentary verification and traceability, especially where recycled content cannot be verified by analytical techniques.

Future Customs Authority of the European Union

- Identify priority areas for control and support coordination between national customs administrations.
- Promote a more homogeneous application of controls at the various external borders of the Union.

European Chemicals Agency (ECHA) and its Enforcement Forum

- Develop common methodologies and best practices and facilitate training and information exchange among inspectors.

Ministry of Finance and State Tax Administration Agency

- Act as the main national interlocutors to determine the needs for human resources, training and technology and to coordinate their reinforcement.
- Exchange information with the Ministry for Ecological Transition and the Demographic Challenge (MITECO), market surveillance authorities and European institutions.
- Assess and strengthen the needs for personnel, training and technological resources, promoting interoperability and the stable exchange of information with the competent national and European authorities.

Ministry for Ecological Transition and the Demographic Challenge and Ministry of Health

- Coordinate with Customs the verification of CBAM obligations, including emissions data and the carbon price effectively paid in the country of origin, and provide practical guidance for compliance.

Ministry of Industry and Tourism

- Coordinate national actions for monitoring the market of industrial products within its area of competence and to promote national control campaigns.
- Incorporate the information obtained from the surveillance activities into the analysis of competitiveness and industrial value chains.

Autonomous communities

- Carry out inspection, surveillance and compliance control actions within their respective areas of competence.
- Share the non-conformities detected with the other competent authorities and strengthen the training and resources necessary to facilitate coordinated actions between territories.

Importers, companies, digital platforms, laboratories and accreditation bodies

- Ensure the availability and reliability of the required information on imported products, including documentation that proves the recycled or renewable origin of the materials.

- Cooperate with the authorities during inspections and keep the necessary supporting documentation.
- Provide technical capacity for analysis, testing, accreditation and verification.

Potential barriers

- Fragmentation of powers among customs, environmental, health, industrial and regional authorities, which may hinder coordinated action.
- High volume and increasing complexity of imports, especially through electronic commerce, which makes it impossible to subject all operations to physical controls.
- Differences in the intensity and criteria of surveillance between Member States and territories, which may lead to unequal application of the rules.
- Technical complexity of chemical chains, which makes it difficult to identify substances, compositions, precursors and regulatory obligations based solely on customs classification.
- Uneven availability of reliable data from third countries, particularly for verifying emissions, composition or environmental attributes.
- Limited capacity of inspection staff, laboratories and verifiers to respond to an increase in control needs.
- Inability to analytically distinguish certain recycled materials from their virgin equivalents when they have the same chemical composition.
- Lack of clarity on what checks should be carried out before importation, at customs or during subsequent market surveillance.
- Lack of full interoperability between registries, customs systems and market surveillance tools, especially during the transition period to the new Customs Data Centre.
- Risk of shifting excessive administrative burdens to compliant operators if controls are not designed according to a proportionate approach.
- The need to ensure that surveillance is limited to legally applicable and verifiable requirements, avoiding turning conformity controls into de facto trade barriers.



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