Ideas for action

DECEMBER 2025

Accelerating the decarbonization of industry

Recommendations from multi-stakeholder dialogue

alinnea

alinnea

alinnea has been a key player in Spain's climate action ecosystem since mid-2024. As part of IE University and supported by the European Climate Foundation, alinnea specializes in comparative analysis, identification, and articulation of climate change measures and actions that engage the public and private sectors, as well as civil society.

Operating under a multi-stakeholder, dialogue-research-action framework, **alinnea** seeks to develop solutions that overcome climate action barriers while ensuring they are socially just, economically viable, and beneficial for the environment and biodiversity protection.

Between May and October 2025, **alinnea** held working sessions with more than forty stakeholders—from the public and private sectors, multilateral organizations and academia—with the aim of accelerating the decarbonization of industry in Spain. This process made it possible to gather critical analyses and highly relevant practical experiences

Drawing on this dialogue, the report provides an in-depth analysis of the main obstacles facing Spanish industry in the ecological transition and identifies priority measures to advance its decarbonization.

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Design and layout:
Epoq Studio, epoqstudio.com

Photos:
Shutterstock and Unsplash

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With the support of

European Climate Foundation

Cite as:
IE Foundation. "Accelerating the decarbonization of industry", Ideas for Action series. Madrid, alinnea 2025.

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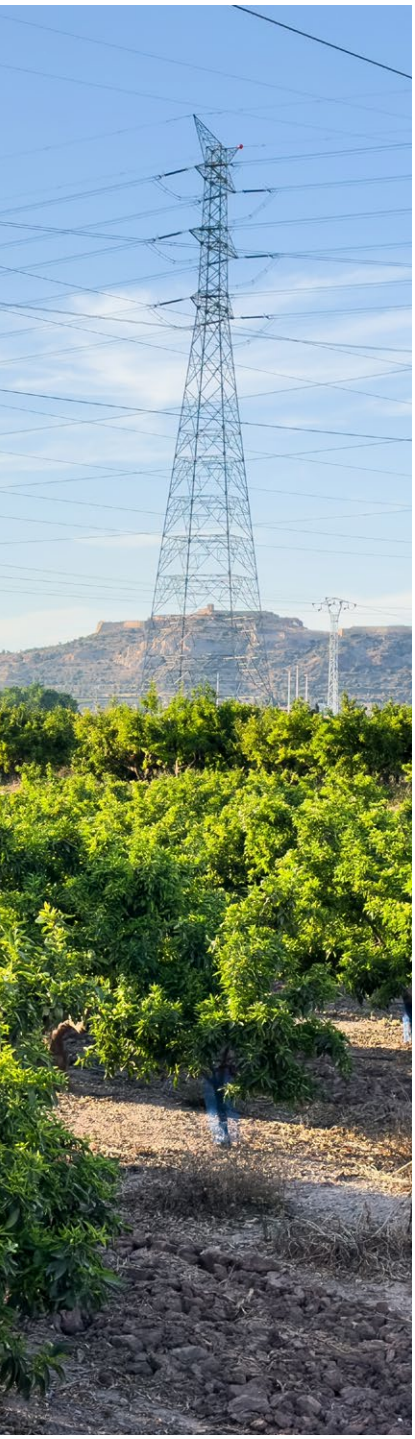

Spanish industry is at the heart of the transformation towards a competitive, low-carbon economy. This report presents the work of the Working Group on "Identifying priority measures to advance the decarbonization of industry in Spain", which brought together public administration, the private sector, the financial sector, civil society, and academia to identify the bottlenecks slowing the transition and to agree on concrete proposals to address them.

The starting point is the need for multi-stakeholder dialogue to identify both the barriers facing the sector and the options for future action. Industrial decarbonization requires a plurality of technologies, financing instruments aligned with risk, and coordinated public and corporate decision-making, with a practical focus on Spain's productive reality. **Ten bottlenecks emerged from the dialogue** that condition the pace of investment and competitiveness. First, electricity prices in Spain and Europe remain higher than those of global competitors, with a considerable impact on industrial location decisions.

- Electrifying production is one of the main pathways for decarbonizing many industrial activities, making the cost of this input critical to the viability of the strategy.
- Persistent constraints in energy supply and renewable storage hinder the signing of stable, scalable contracts and limit the use of renewable energy as a decarbonization option, particularly for electro-intensive industries.
- Industries reliant on liquid and gaseous fuels, including refining, petrochemicals, fertilizers, steel, cement, glass and ceramics, and pulp and paper, continue to face very high costs.
- Barriers remain to scaling up direct emissions-mitigation technologies (scope 1), from fuel substitution to CO_2 capture and management, which are not advancing at the pace required. In manufacturing sectors such as automotive, most emissions arise in the value chain (scope 3), requiring targeted measures to strengthen collaboration with raw-material suppliers.
- The carbon price, that is, the price of emission allowances for regulated installations, still has limited influence on industrial decision-making and currently weighs less than other investment drivers, particularly economic cost.

- Large companies and SMEs differ significantly in their capacity to adapt: large firms can better finance, manage and absorb technical and administrative complexity, while SMEs face higher barriers to entry.
- Fiscal incentives remain insufficient to improve industrial competitiveness and to accelerate the decarbonization process.
- Public financing instruments are fragmented and difficult to navigate, which delays project development and implementation.
- Private financing is not yet sufficiently aligned with the needs of industrial decarbonization, particularly in terms of risk profiles, maturities and financing structures.
- The transition entails labor-market risks and requires just-transition policies that protect industrial employment, anticipate reskilling needs and support the territories most exposed to change. Finally, a cross-cutting bottleneck across all of the above is the limited social acceptance of new energy and industrial infrastructure, which can block strategic projects and calls for inclusive governance, early engagement and tangible benefits for local communities.

On this basis, the Working Group puts forward a set of concrete proposals to address the identified bottlenecks. Together, they respond directly to the ten bottlenecks:

- Improve access to renewable electricity and storage to give industry certainty on volumes, prices, and flexibility. The objective is to reduce the final cost of electricity for industrial uses by combining long-term contracting instruments with improved grid management and the orderly deployment of interconnections and storage.
- Facilitate access to direct emissions-mitigation technologies (scope 1) by providing targeted technical assistance and risk-sharing frameworks that accelerate deployment.
- Promote technical knowledge transfer and best practices so that proven solutions become standardized and accessible to SMEs, reducing learning curves and adoption costs.
- Provide technical assistance in preparing green investment projects, professionalizing project development so that initiatives can attract public and private financing and form bankable project pipelines.
- Promote communities of practice and spaces for sectoral and territorial collaboration, enabling companies, public administrations, and financiers to share solutions and coordinate action.

- Simplify access to public funding by harmonizing requirements and establishing one-stop-shop systems with common criteria, preventing lost opportunities from lengthy authorization procedures or administrative complexity.
- Establish observatories to monitor industrial employment linked to the green transition, with a focus on anticipating skills needs, guiding training programs, and designing just-transition measures.
- Strengthen the project-financing ecosystem, ensuring that the entire productive fabric can access improvement solutions, and reinforce education and training for reskilling to guarantee a sufficient supply of qualified professionals to support the transition.
- Improve social acceptance of green projects to ensure an inclusive transition that benefits society as a whole. This requires reducing perceived risks, shortening decision-making timelines, and aligning prices, technologies, and financing within a practical and competitive framework. Under these conditions, industrial decarbonization can become a competitive advantage, attracting investment, accelerating innovation, and sustaining quality employment. Inaction or weak signals, by contrast, would lead to a loss of productive capacity in an increasingly competitive global context.

Rather than seeking to close the debate, this report organizes it and directs it towards concrete decisions that Spain can and must take now, grounded in a realistic assessment of its sectors, territories and capabilities.

The central conviction remains that green industry and industrial decarbonization are, above all, an opportunity to innovate and strengthen the sector's competitiveness.

Introduction 02

This report presents the main conclusions of the Working Group "Identifying priority measures to advance the decarbonization of industry in Spain", established by **alinnea** to identify the bottlenecks facing the industrial sector in relation to climate action and to determine the measures needed to advance its decarbonization.

Within this framework, the Working Group brought together representatives from public administration, the private sector, the financial sector, civil society, and academia to analyze the main obstacles slowing industrial transformation. Throughout the report, these challenges are examined and concrete proposals are put forward to address them.

The transition of the industrial sector, in the context of the European Union's (EU) 2050 climate-neutrality target established under the European Climate Law, requires urgent attention to the role of industry. In 2024, industry accounted for 20% of greenhouse gas emissions in Spain[1] and 20.3% in the EU[2]. Industrial decarbonization is therefore not only an environmental objective, but also a strategic lever for ensuring competitiveness, resilience, and economic autonomy in both Spain and the EU.

In Spain, the industrial sector represented around 22% of gross domestic product (GDP) in 2025 and approximately 12.3% of direct employment[3] rising to 26–33% of wage earners when indirect employment is included[4]. It accounts for around 20% of direct greenhouse gas (GHG) emissions, many of which are difficult to abate with current technologies. Industry also supplies critical inputs to sectors such as construction, transport, energy, and food, and exerts a strong pull on the wider economy. For these reasons, accelerating industrial decarbonization is essential to meeting Spain's climate targets, maintaining industrial employment, fostering innovation in low-carbon technologies, and ensuring sustainable and inclusive economic development.

1 Miteco (2024g), Section 3, in 2023, the industrial sector generated 54.9 $MtCO_2$ eq (see Figure 1), equivalent to approximately 20% of the national total.

2 Greenhouse gas emissions by country and sector (infographic) (2024).

3 Calculated using data from the National Statistics Institute (INE, 2025). Labor Force Survey (LFS), Q1 2025. Manufacturing industry (including 33 CNAE 2009 subsectors): 2,619.3 thousand employees / 21,765.4 thousand employed persons = 12.03%.

4 BBVA Foundation (2025, 22 July)

This report is therefore conceived as a tool to highlight opportunities for advancing industrial decarbonization and to support decision-making by the stakeholders linked to industry in Spain.

Its objective is to provide a shared diagnosis of the main challenges shaping the transition and, on that basis, to propose concrete and actionable solutions. The intention is to guide public policymakers, businesses, the financial sector, and civil society organizations, including trade unions and NGOs, and to help accelerate the transition towards a green, competitive industry aligned with European and international climate commitments.

We would like to extend our sincere thanks to the members of this working group for sharing their ideas, reflections, and time, as well as to the experts who contributed their valuable knowledge through presentations.

The findings, analyses, and conclusions presented in this report are based on publicly available information—obtained from primary sources or from other research cited herein—and considered accurate and reliable. None of the collaborating individuals or institutions shall be held responsible for how the information contained in this document is interpreted, nor for any losses resulting from decisions of any kind made on the basis of this report. Also, thanking or recognizing an organization doesn't mean it endorses the final text.

2.1 Objectives of the Working Group

The working group "Identifying priority measures to advance the decarbonization of industry in Spain" brought together representatives from public administration, the private sector, the financial sector, civil society, and academia to analyze the main obstacles slowing industrial transformation. Throughout this report, these challenges are examined and concrete proposals are put forward to address them.

The transition of the industrial sector, within the framework of the European Union's (EU) 2050 climate-neutrality target established under the European Climate Law, requires urgent attention to the role of industry, a sector that accounted for 20% of greenhouse gas emissions in Spain[5] in 2024, and 20.3% in the EU[6]. Industrial decarbonization is not only an environmental objective, but also a strategic lever for ensuring the competitiveness, resilience, and economic autonomy of both the country and the EU.

In 2024, industry accounted for 20% of greenhouse gas emissions in Spain and 20.3% in the EU.

In Spain, the industrial sector represents around 22% of gross domestic product (GDP) and approximately 12.3% of direct employment, rising to 26–33% of wage earners when indirect employment is included[7], It accounts for around 20% of direct greenhouse gas (GHG) emissions, many of which are difficult to abate with current technologies. Industry also provides critical inputs to sectors such as construction, transport, energy, and food, and exerts a strong pull on the wider economy. Accelerating its decarbonization is therefore essential for achieving Spain's climate goals, maintaining industrial employment, fostering innovation linked to low-carbon technologies, and ensuring sustainable and inclusive economic development.

This report is conceived as a tool to highlight opportunities for advancing the sector's decarbonization and to support decision-making by the various stakeholders linked to industry in Spain. Its objective is to provide a shared diagnosis of the main challenges shaping industrial decarbonization and, on that basis, to propose concrete and actionable solutions. The aim is to guide public-policy makers, businesses, the financial sector, and social organizations including trade unions and NGOs, thereby helping to accelerate the transition towards a green and competitive industry aligned with European and international climate commitments.

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5 Emissions Spain, as described in section 3 National Greenhouse Gas Inventory, in 2023 the industrial sector generated 54.9 $MtCO_2$ eq, see figure 1, equivalent to approximately 20% of the national total, https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/es-nir-edicion-2024.pdf

6 EU Emissions—from the European Parliament, https://www.europarl.europa.eu/topics/es/article/20180301STO98928/emisiones-de-gases-de-efecto-invernadero-por-pais-y-sector-infografia—latest version 2024

7 The manufacturing industry has lost a quarter of its jobs and 6.1 percentage points of its contribution to Spanish income since the beginning of the century—BBVA Foundation

2.2 Methodology

The methodology used to prepare this report was based on a series of working sessions, held under the Chatham House Rules, aimed at identifying priority measures to advance the decarbonization of industry in Spain. This process enabled the development of a set of recommendations designed to accelerate industrial decarbonization.

The work brought together a diverse group of participants from public administrations, the private sector, civil society, and academia. Three working sessions were held between May and July 2025. The first session focused on assessing the current situation of the industrial sector and identifying its main challenges, including an in-depth discussion of the geopolitical dimensions of decarbonization. The second session addressed energy and decarbonization technologies, while the third examined the financing of industrial decarbonization. In September 2025, an additional meeting was held to jointly review and validate the content of the report.

Three dialogue sessions were held between May and July 2025.
An additional meeting took place in September 2025 to jointly review the content of the report.

- **Session 1:** Overview of the sector and identification of key bottlenecks. The geopolitics of decarbonization
- **Session 2:** Energy and decarbonization technologies
- **Session 3:** Financing industrial decarbonization

During these sessions, presentations were delivered by the entities listed below, covering the topics indicated. We would like to thank all contributors for their time and valuable input.

- **Key challenges for industrial decarbonization in Spain.**
  Timo Cordeiro Gerres, Energy Policy Coordinator at Enagás and Researcher at the Institute for Technological Research, Comillas Pontifical University.
- **State of the art of clean technologies for decarbonizing Spanish industry and the main barriers to their deployment.** Bianca Dragomir, Director, Cleantech for Iberia.
- **Industrial decarbonization for thermal applications.**
  Javier Mazorra, Researcher at the Centre for Innovation in Technology for Human Development, Polytechnic University of Madrid; Coordinator of the Q-Cero Network.
- **Thermal energy storage technologies.**
  Alberto Toril, Advisory Board Member at H2Talent, Green Finance Institute, and Cleantech for Iberia.

- **Comparison of certified energy savings schemes and the importance of verification and monitoring in Spain, France, and Italy.**
  Marta Escamilla, Sustainability Area Manager, Leitat.
- **Energy storage: the current state of the technology.**
  Eduardo Martín Fernández-Pacheco, Associate Data Scientist – Advanced Analytics, Global Energy Management Department, EDP Technology Center.
- **Decarbonization of heavy industry.**
  Alexis Stavropoulos, Director, Energy Sector Investment Advisory in Iberia, Baringa.
- **The project at Bayer Hispania's plant in La Felguera.**
  Francisco Laverón Simavilla, Energy Policy Officer, Iberdrola.
- **Energy price scenarios and their impact on decarbonization.**
  Javier Revuelta, Senior Principal, AFRY.
- **Decarbonization case study.**
  Sagrario Sáez Mejía, Director of Sustainability, Heineken.
- **European Investment Bank (EIB) financial instruments.**
  Fernando Torija, Head of the Spain Office, European Investment Bank (EIB).
- **Access to public funding programs.**
  Fernando Pérez Miguel, Director of the Madrid Office and Director of Sustainable Business Products Coordination, Zabala Innovation.
- **Challenges in accessing private finance: the SME perspective.**
  María Teresa Ruiz Costal, Head of Sustainability and European Funds, Ibercaja.
- **PERTE programs, ICO financing, and EIF and EIB guarantee schemes for industrial decarbonization.**
  Álvaro Colino, Director of Sustainable Business Products Coordination, CaixaBank.
- **Employment in industrial decarbonization.**
  Jesús Crespo, Head of Raw Materials, Industry Federation of Comisiones Obreras (CCOO).

The working group received technical support from researcher Bettina Schreck, an international specialist in decarbonization and green industry, and from Cristina Monge Lasierra, a political scientist and specialist in sustainability governance, who facilitated the working sessions.

Relevance of the industrial sector in decarbonization

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03

The industrial sector has traditionally been one of the main drivers of economic growth and is also one of the main sources of energy consumption. Although these two dimensions are often linked, with greater economic growth typically leading to increased energy consumption, measures can be implemented that decouple this relationship, enabling more efficient and sustainable industrial development (UNIDO, 2009).

The industrial sector accounted for around 22% of Spanish GDP in 2024, including manufacturing, construction, and energy supply (INE, 2025). Manufacturing employed approximately 12.3% of the working population in Spain in 2024 (INE, 2024b) while total industrial energy consumption the same year is estimated at around 23.6 ktep (MITECO, 2024a).

According to the National Greenhouse Gas Inventory, in 2023 the industrial sector generated 58.1 $MtCO_2eq$ (MITECO, 2024b), see Figure 1, equivalent to approximately 21% of the national total[8] (MITECO, 2024b). This volume makes it one of the main emitting sectors, with a significant share of the 20%-30% attributable to complex processes that are not easily electrifiable (MITECO, 2024c). The sector's clear relative weight in emissions underlines the urgency of focusing industrial decarbonization policies.

This section presents a diagnostic overview of the Spanish industrial sector, beginning with the influence of European guidelines and policies.

8 Excluding land use, land-use change and forestry (LULUCF).

3.1 Decarbonization: from sustainability to European competitiveness

Europe is currently undergoing a transformation of its economic model in the wake of the pandemic, the war in Ukraine, and rising trade tensions.

Europe is currently undergoing a transformation of its economic model in the wake of the pandemic, the war in Ukraine, and rising trade tensions. The erosion of the multilateral order and the energy crisis have highlighted the need to strengthen strategic autonomy and industrial resilience. The war in Ukraine and the subsequent energy crisis underscored the urgency of ensuring the European Union's energy independence. At the same time, the increase in tariffs imposed by the United States has weakened the notion of a globalized free market governed by stable and predictable rules, increasing uncertainty about the short- and medium-term outlook for international trade. In parallel, the long-standing European "peace dividend", which provided a stable and secure environment for economic growth, has given way to a context of geopolitical competition that requires competitiveness to be reassessed through the lens of sustainability. Together, these developments have eroded the foundations of the European industrial model and made it necessary to rethink competitiveness from a more resilient and strategic perspective, with decarbonization at its core.

Another pillar of the European industrial model was the relocation of production to China and other Asian countries in pursuit of lower labor costs and short-term competitiveness. While initially advantageous, this pattern has generated a high degree of external dependence in strategic sectors, particularly those linked to the green transition. These include solar panel manufacturing, batteries and electric vehicles, hydrogen technologies, semiconductors, and electronic components.

In this context, it is important to recall that the European Union had already set a strategic course through the European Climate Law (Regulation (EU) 2021/1119), which makes the 2050 climate-neutrality objective legally binding and establishes a minimum emissions-reduction target of 55% by 2030. This regulation not only defines the long-term direction but also acts as a regulatory anchor for EU industrial, energy, and innovation policy, reinforcing the need to channel investment into clean technologies and low-carbon production processes.

Today, more than,
+80 %
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Today, more than 80% of global photovoltaic solar panel manufacturing, over 70% of battery component production, and a large share of critical raw material refining are concentrated in China. This concentration poses risks to security of supply and Europe's strategic autonomy, reinforcing the urgency of initiatives such as the Net-Zero Industry Act and the Critical Raw Materials Act, which seek to restore industrial production capacity within the European Union.

These shifts in the global context were analyzed in depth in two reports published in 2024. Mario Draghi's report on European competitiveness sets out a roadmap for reversing the EU's competitive decline and identifies three priorities: improving productivity and technological innovation, decarbonizing the economy in a way that enhances productivity, and strengthening Europe's strategic autonomy and security. Meanwhile, Enrico Letta's Single Market report (Letta, E. 2024) focuses on reforming the single market and highlights the need for an integrated vision to strengthen the competitiveness of the European bloc in an increasingly complex global environment. In the energy domain, the report highlights the fragmentation of electricity markets, noting that investment signals still depend largely on national decisions. It also calls for deeper integration of the energy sector into the single market and closer alignment with industry, as competitive energy prices reduce costs for consumers and industry alike.

This paradigm shift is reflected in the Competitiveness Compass for Europe, a model that prioritizes economic strength based on efficiency, technological autonomy, and sustainability. Published in January 2025, the Compass sets out the European Commission's strategic and operational priorities for the 2024–2029 period. It is structured around three core priorities: innovation, decarbonization, and reducing strategic dependencies. It includes measures such as the Clean Industrial Deal to support the low-carbon industrial transition, specific plans for energy-intensive sectors, and a strategy to diversify and secure critical supply chains.

The Clean Industrial Deal provides a strategic policy framework to guide the transformation of European industry towards a low-carbon, competitive, and resilient model. Beyond shaping EU-level policy, it also serves as a reference framework for Member States in designing national strategies aligned with climate objectives, energy security, and innovation.

The Deal is based on six pillars:

* **Affordable energy:** ensuring that industry has access to clean energy at competitive prices to maintain productivity and attract investment.
* **Lead markets:** stimulating demand for clean products and technologies by creating stable markets that foster innovation and local production.
* **Financing for the clean transition:** mobilizing public and private capital for industrial projects that reduce emissions and improve efficiency.
* **Circular economy:** promoting reuse, recycling, and the efficient use of resources to reduce dependence on virgin raw materials.
* **Global partnerships:** strengthening international cooperation to ensure diversified and sustainable supply chains.
* **Skills and quality employment:** developing the skills and capabilities required in the workforce to support the industrial transition and ensure stable, well-paid jobs.

The Carbon Border Adjustment Mechanism (CBAM), closely linked to the new EU Emissions Trading System (EU ETS), is a regulatory instrument of the European Union designed to apply a carbon cost equivalent to the emissions embedded in imported goods, ensuring that products manufactured outside the bloc comply with climate standards comparable to those in Europe (European Commission, 2024c). Its main objective is to prevent carbon leakage and protect the competitiveness of European industry by aligning climate policy with trade policy. The initial phase began in October 2023 and will conclude in December 2025. During this transitional period of reporting and implementation, importers are required to declare the embedded emissions of products such as cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen, but without any obligation to purchase or surrender CBAM certificates. This gradual rollout is intended to give companies and public administrations time to adapt, while allowing control and verification mechanisms to be refined before the system becomes fully operational with associated financial obligations.

On the following pages is a summary of the main EU regulations on industrial decarbonization.

Table 1.
European regulations on industrial decarbonization

Regulation (EU)	Main objective	Scope of application	Key mechanisms
EU Emissions Trading Scheme (ETS) Directive 2003/87/EC as amended by Directive (EU) 2023/959)	Reduce GHG emissions by **62% in 2030 compared to 2005** in the sectors covered, internalizing the cost of carbon. Extends the carbon price signal to fuels for buildings, road transport and small industrial consumers.	**ETS 1** * Includes combustion installations ≥ 20 MW (electricity, steel, refining, cement, chemicals, paper). * Aviation remains covered, but its free allocation is being phased out by 2026. * Maritime transport is incorporated from 2024 with full coverage in 2026. **ETS 2** * It is a parallel system that will come into force in 2027 (possible delay to 2028 if energy prices are high). * It covers fossil fuel consumption in buildings, road transport and small consumers. Part of the revenue goes to the Social Climate Fund.	* Imposes an annual CO_2 limit in the EU with progressive reduction. * Establishes a carbon market: creates the obligation to surrender one permit per ton of CO_2 equivalent emitted. * Allocates credits through auctions of rights and free allocation during the transition. The funds raised are used to support clean technologies, climate action or social measures.
Carbon Border Adjustment Mechanism (CBAM) Regulation (EU) 2023/956	Prevent carbon leakage by making CO_2-intensive imports more expensive at the ETS Emissions Trading Scheme level.	Scope: cement, iron and steel, aluminum, fertilizers, electricity and hydrogen (including certain precursors and some intermediate goods identified by CN codes). The carbon price effectively paid in the third country is recognized and deducted.	* Establishes a CO_2 tariff on imports through the purchase of CBAM certificates based on CO_2 content * Initial phase Initially, there is only an obligation to report imported emissions (1 October 2023-31 December 2025). * From 2026 onwards, the CBAM will be gradually implemented, with an obligation to purchase and surrender certificates, in parallel with the phasing out of free allowances in the ETS for the sectors concerned.
Net Zero Emissions Industry Act Regulation (EU) 2024/1735	Strengthen the manufacturing of clean technologies in the EU to achieve climate neutrality by 2050 and reduce dependence on strategic imports.	Strategic zero-emission technologies such as solar, wind, batteries, hydrogen, heat pumps, carbon dioxide capture, utilization and storage.	It introduces the concept of Strategic Net Zero Emission Projects, which benefit from fast-track authorization procedures, defined maximum timeframes and priority access to financing.
Critical Raw Materials Act (CRMA) Regulation (EU) 2024/1252 of 11 April 2024	Ensuring a secure, diversified and sustainable supply of critical and strategic raw materials for the European economy, reducing external dependencies and strengthening the EU's strategic autonomy.	Non-energy raw materials essential for the green and digital transition, included in the list of critical and strategic raw materials such as lithium, cobalt, nickel, rare earths, graphite	* It sets 2030 benchmarks for the extraction, processing and recycling of these raw materials. * It sets a target that, for each strategic raw material, no more than 65% of the EU's annual consumption should come from a single third country. * Establishes strategic projects with fast-track permits: – 27 months for extraction projects – 15 months for processing or recycling

Regulation (EU)	Main objective	Scope of application	Key mechanisms
Renewable Energy Directive Network III (2023/2413)	Increasing the share of renewable energies, including industry	Electricity, heating/cooling, transport, hydrogen, etc.	* EU-wide target of 42.5% renewables by 2030 (with an aspiration of 45%); RFNBO quotas in industry/transport. * The accounting and additionality rules for RFNBO have been adopted through delegated acts in 2023 and must be fully integrated into national frameworks by 2025. * The regulation introduces quotas for renewable fuels of non-biological origin (RFNBO) in both industry and transport.
Energy Efficiency Directive (EED, 2023/1791)	Advancing energy efficiency in the EU	Applies to all sectors, with a focus on reducing end consumption (electricity, heat, and fuels).	The EU must cut its consumption by 11.7% by 2030 compared to 2020 projections, and each Member State must achieve measurable annual savings to contribute to that goal.
Industrial Emissions Directive 2024/1785 and the Emissions Portal (Regulation 2024/1244)	Update of IPPC permits for industrial facilities and intensive pig and poultry farms. The portal will centralize the environmental information reported by the plants.	Industrial facilities	* The IED tightens integrated permits (IPPC) with more demanding BATs and broadens their scope (including intensive livestock farms), requiring permits to be updated as new BAT conclusions are adopted. * The Portal centralizes the data reported by facilities (emissions, waste, use of water, energy and raw materials) in a public database.
Hydrogen and decarbonized gas package (Directive 2024/1788 and Regulation 2024/1789)	Establishing rules for hydrogen and renewable/low-carbon gas networks and markets	Infrastructure and internal market for gas/H_2	The package establishes third-party access to gas and hydrogen networks, requires the legal, functional, and accounting unbundling of hydrogen activities to prevent discrimination and cross-subsidization, enables joint gas purchasing at the EU level to strengthen security of supply, and creates a European hydrogen support mechanism to unlock investment and facilitate long-term contracts.
Methane Regulation Reg. 2024/1787	Reducing methane emissions in oil, gas and coal	Energy value chain in the European Union	Implements a strict monitoring, reporting and verification (MRV) system, mandates regular leak detection and repair (LDAR) programs with deadlines for rectification, and severely restricts routine venting and flaring, allowing them only for safety or emergency reasons and under specific limits for oil, gas and coal operators.

Decarbonization can be approached as an opportunity for innovation, driving accelerated change in production processes. It is in this sector that future competitiveness and strategic autonomy are at stake (European Commission, 2020). In this context, different stages of the industrial value chain can be viewed as opportunities to reduce emissions.

Beginning with unit operations, industries can modify their production processes: some require structural changes in the way they deliver their services, while others need more radical transformations in how their facilities operate (IEA, 2022). They can then improve their process efficiency to reduce their energy requirements (UNIDO, 2022).

3.2 Spanish decarbonization regulations

The **Integrated National Energy and Climate Plan (PNIEC)**, published in 2021, is the main planning instrument for defining Spain's climate and energy policy (Government of Spain, 2021a). It sets out the energy and emissions-reduction targets for 2021–2030 and establishes more than one hundred measures to achieve them. In 2024, an updated version was approved that reinforces climate ambition by increasing the targets for renewable energy penetration, energy efficiency and emissions reduction. The plan addresses a wide range of issues, including decarbonization, energy efficiency, energy security, the internal energy market and R&D&I. For industry, the PNIEC proposes accelerating decarbonization through process electrification, the use of renewable hydrogen and improved efficiency in energy-intensive sectors, combining regulatory instruments, financial support and promoting technological innovation.

In 2021, Spain approved Law 7/2021 on Climate Change and Energy Transition. This law sets specific targets for 2030, including reducing greenhouse gas emissions by at least 23% compared to 1990, achieving a minimum of 42% renewable energy in final consumption, improving energy efficiency by reducing primary energy consumption by at least 39.5%, and ensuring that 74% of electricity generation is from renewable sources.

The law serves as a roadmap for all public policies on energy and climate, aligned with the Paris Agreement and European legislation. Since its adoption, a large number of regulations and provisions have been enacted, including laws, royal decrees and ministerial orders, among others, partly aimed at implementing its mandates.

The Draft Law on Industry and Strategic Autonomy, under consideration in the Congress of Deputies as of October 2025, would update Spain's industrial regulatory framework to adapt it to the challenges of the ecological and digital transitions. Its objectives include strengthening competitiveness, modernizing the productive fabric, promoting innovation and improving the resilience of supply chains. In line with the Climate Change Law and the PNIEC, the draft law incorporates measures to advance industrial decarbonization, such as promoting clean technologies, integrating energy-efficiency criteria into production processes and supporting the circular economy. These provisions seek to guide Spanish industry towards a more sustainable and competitive model, capable of generating added value and quality employment in an increasingly demanding global environmental context.

The Government of Spain is also preparing a Royal Decree to implement Regulation (EU) 2024/1735 Net-Zero Industry Act (NZIA), designating the competent authority, establishing a one-stop shop and setting maximum processing times, as well as defining the regime for 'strategic projects' and their interaction with public procurement and State aid. The decree will also adapt Spanish legislation to Regulation (EU) 2024/1252 on Critical Raw Materials, including measures such as establishing a national Single Point of Contact for investors in critical raw materials. This regulation was already submitted for public consultation in April 2025.

In parallel, Spain is progressing in transposing the key European package for industrial decarbonization. In terms of renewable energy, significant steps have already been taken with regard to RED III (Directive (EU) 2023/2413): preliminary consultations and subsequent public hearings have been held for the transposition of part of its content. In energy efficiency (Directive (EU) 2023/1791), the process has begun with preliminary consultations and public hearings.

With regard to the gas and hydrogen markets (Directive (EU) 2024/1788), a preliminary public consultation was launched in autumn 2024 for the transposition of the Directive. In the case of **emission allowances (EU ETS)**, transposition has followed a complex path: the draft law was withdrawn from the Congress of Deputies in February, and subsequently reintroduced as a parliamentary bill, restarting the legislative process. Finally, for industrial emissions (Directive (EU) 2024/1785), a preliminary public consultation was held in early 2025, followed by the preparation of the draft for public hearing.

Table 2.
Regulatory initiatives on industrial decarbonization—own elaboration

Regulatory project	Main objective	Scope of application	Key mechanisms
Draft Law on Industry and Strategic Autonomy **Pending approval by the Congress of Deputies**	Modernizing the industrial legal framework after 30 years, promoting reindustrialization, strategic autonomy and environmental sustainability in Spanish industry.	Manufacturing industry in Spain (excluding energy), public administrations with industrial responsibilities (State and Autonomous Communities)	* It will integrate digitization and decarbonization objectives into industrial policy. * It will institutionalize PERTE as a permanent instrument and provide criteria for declaring and coordinating them. * It will provide protection to electricity-intensive industries with specific competitive support mechanisms.
Draft Royal Decree implementing the Fundamental Raw Materials Act and the Net-Zero Industry Act (NZIA) **In preparation, public information phase in April 2025**	Adapting Spanish administration to the Net Zero Emissions Industry Regulations and Critical Raw Materials Regulations	* Industrial projects for net-zero emission technologies in Spain * Projects for the extraction and refining of critical raw materials	* It will designate a Single Window for projects to streamline environmental and urban planning licenses. * It will establish criteria for declaring a project a national NZIA Strategic Project. * It will establish single points of contact for critical raw materials projects, including a state point of contact when the project falls within the remit of the General State Administration or affects several autonomous communities.
Transposition of European directives	Incorporate the new climate regulations approved through directives into legislation.	Energy sector, industrial sector	**RED III—Renewables** * The electrification of processes and the use of renewable hydrogen in industry are promoted. * Permits are expedited, and self-consumption and long-term energy contracts are facilitated. **EED—Energy efficiency** * Countries must achieve annual energy savings and extend audits or management systems. * The Administration reduces its consumption and purchases more efficient equipment and services. **Gas and hydrogen** * Access to networks is guaranteed and hydrogen management is separated to avoid discrimination. * Renewable gases are integrated and contracts and infrastructure for hydrogen are supported. **EU ETS—Emission rights** * The price of carbon drives decarbonization and free allocation decreases over time. * Auction revenues finance innovation and industrial decarbonization projects. **Industrial emissions** * Permits are tightened with best available techniques and updated when they change. * Resource use is improved, and emissions monitoring and reporting is digitized.

3.3 Financial instruments for decarbonization in Spain

Strategic Projects for Economic Recovery and Transformation (PERTE) are public–private partnership instruments established under the Recovery, Transformation and Resilience Plan to channel investment towards strategic sectors (Government of Spain, 2021b). There are different PERTE initiatives for each economic sector or technology, such as renewable energy, electric vehicles or the agri-food sector.

For the industrial sector, the PERTE for Industrial Decarbonization, approved in 2022, mobilizes public and private resources to support industries in reducing their emissions. It is structured around four lines of action:

* Comprehensive industrial decarbonization projects in industrial plants
* The promotion of renewable hydrogen for industrial uses
* Technological reconversion and improvements in energy efficiency; and
* Support for studies and innovation projects that facilitate the transition to low-carbon production processes (Government of Spain, 2023a).

These lines of action are detailed in Table 3. The aim is to accelerate the modernization of the industrial sector, enhance its competitiveness and contribute to meeting national and European climate objectives.

Table 3.
Financing lines of the PERTE for Industrial Decarbonization—own elaboration

Call for proposals	Budget allocation	Award	Results
Line 1 2024—Comprehensive Action Projects for Industrial Decarbonization	**€1 billion** (€500 million in grants + €500 million in repayable loans), with funding from the Recovery Plan (NextGen EU)	Aid under a non-competitive scheme (awarded in order of application to those who meet the requirements until funds are exhausted)—DG Industrial Programs	* 144 projects submitted for €3 billion. * By November 2025, around 96 projects had been approved for more than €527 million.
Line 2 2025—IPCEI on the renewable hydrogen chain	**€524 million** in grants	**Direct concessions**)—after EC selection and MITECO processing	5 projects approved
Line 3 Support fund for carbon contracts for difference	**€100 million** planned	Under study and regulatory design phase for electro-intensive industries: steel, chemicals, cement, paper and pulp, refining	
Line 4 2024—Aid for the Development of New Highly Efficient and Decarbonised Manufacturing Facilities	**€140 million** (€90 million in grants and €50 million in loans), financed through NextGenerationEU funds (Component 31 of the Recovery, Transformation and Resilience Plan – PRTR).	**Competitive call** (competitive bidding, selection based on merit criteria) DG Industrial Programs	5 projects approved for €90 million (provisional decision

Source PRTR, MINTUR

According to official data, Spain achieved a 57.5% reduction in emissions regulated under the EU ETS between 2005 and 2023, which is a significant decrease that exceeds the European average (MITECO, 2024c). The system was subsequently extended to the aviation sector and later to maritime transport. It is currently being expanded towards EU ETS2, which will extend emissions trading to new sectors such as road transport and buildings, introducing a carbon price in areas not previously covered.

In addition to this PERTE, Spain has various sources of public and private financing to drive industrial decarbonization, through both national and European programs as well as market-based instruments (MITECO, 2024d). However, small and medium-sized enterprises often encounter barriers to accessing these resources, whether due to limited technical capacity to prepare projects, demanding financial requirements or lack of awareness of funding calls (Bank of Spain, 2023). Added to this is the administrative challenge of mobilizing available public funds with sufficient speed, a factor that is crucial for investments to materialize on time and at the scale needed to meet climate targets (European Court of Auditors, 2023).

Spain has support instruments funded through European shared-management funds (ERDF 2021–2027) and national programs, as well as the PERTE for Industrial Decarbonization (managed by the Ministry of Industry), in addition to IDAE programs such as the Aid Program for Energy Efficiency Actions in SMEs and Large Industrial Companies, and financing from ICO. Also noteworthy is the EU Innovation Fund, which is competitive at European level (European Commission, 2021a; MITECO, 2023b; ICO, 2023). These instruments aim to support investment in industrial modernization, electrification, renewable hydrogen and the circular economy, contributing to the achievement of the objectives of the Climate Change Law and the PNIEC (MITECO, 2023b).

In the private sphere, the financial sector has incorporated environmental, social and governance (ESG) criteria into its investment and lending policies. This has led to the creation of products such as green loans, sustainable bonds and climate finance lines designed to support projects that reduce emissions and improve the sustainability of industrial operations (European Investment Bank, 2022). These developments respond both to European regulation on sustainable finance and to growing pressure from investors and consumers for climate-responsible business models (European Commission, 2020).

Despite growing momentum in public policy and the financial sector, current efforts still fall short of the scale and agility needed for this segment of the industrial base to decarbonize at scale.

Although financing for industrial decarbonization is available, access for SMEs remains challenging. Bureaucratic obstacles, limited knowledge of decarbonization technologies and processes, and the fact that their immediate priorities often focus on business growth rather than the energy transition, constrain their investment capacity (Bank of Spain, 2023). Despite growing momentum in public policy and the financial sector, current efforts still fall short of the scale and agility needed for this segment of the industrial base to decarbonize at scale (IEA, 2022a).

3.4 Technologies for decarbonization and their maturity for commercial use and scaling

Companies face emissions within their own control, known as direct emissions, which fall into two main categories: those linked to energy consumption in their operations (fuel combustion for heat, engines, etc.) and those arising from the industrial processes themselves (chemical reactions in production, such as in the manufacture of cement, steel or chemical products) (IPCC, 2022).

According to the National Greenhouse Gas Emissions Inventory, in 2023 the industrial sector accounted for 20.5%[9] of total national emissions, including both types of emissions—energy and process (MITECO, 2024c).

To reduce emissions linked to energy consumption, companies have traditionally relied on energy efficiency measures such as operational improvements, system redesign, equipment replacement with higher-performance alternatives, and the use of renewable energy. These market-ready solutions, including energy management systems, have proven highly effective, delivering operational emissions reductions of between 20% and 30% in industries that implement them (IEA, 2022a).

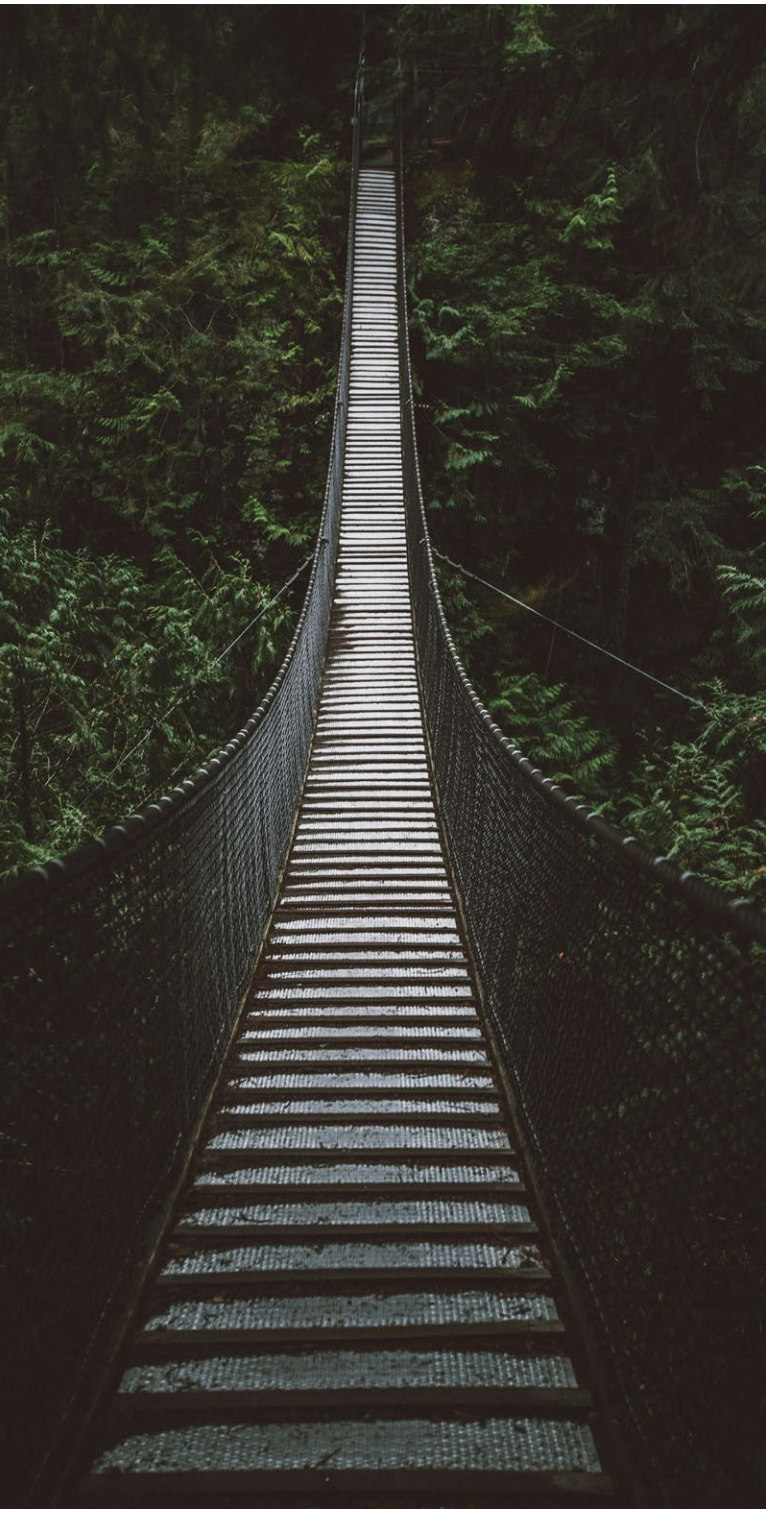
Energy-intensive industrial sectors, such as oil refining, the chemical industry, pulp and paper, iron and steelmaking, and cement, are associated with specific decarbonization technologies. These technologies are commercially proven, and their uptake is advancing gradually according to their cost-effectiveness, as shown in the figures below (European Commission, 2023a).

9 The aggregate value of Industry (combustion), Industry (process emissions) and Refining Industry (combustion) was 58,071 kt CO_2-eq out of a total of 269,968 kt CO_2-eq

Table 4.
Decarbonization technologies for energy-intensive industrial sectors

Iron and Steel	
Electric arc furnace (EAF)) Mature and widespread technology in Spain; basis for renewable electricity.	**[EE] Energy efficiency** Optimization of furnaces and auxiliary systems to reduce demand and emissions.
[RC] Scrap recycling Spain produces 65–70% of its steel via EAF using scrap; increasing its use improves carbon intensity.	**[H2] Direct reduction with H2 (DRI-H2)** Emerging technology; pilots under development, currently high cost.
Cement	
[BM] Fuel substitution with RDF/biomass Mature technology; increasing the substitution rate reduces combustion emissions.	**[CL] Clinker factor reduction** Use of additives (slag, pozzolans, calcined clay) to reduce clinker content.
[CC] Carbon capture, utilization and storage—CCUS Essential in the long term for process emissions; requires deployment at scale.	**[EE] Thermal energy efficiency** Kiln upgrades and waste-heat recovery; high technological maturity, still not widely deployed.
[EL] Thermal electrification Electric furnaces or the use of H_2 as a fuel; technologies still in early stages.	**[EC] Circular economy** Recycling and recarbonation as complementary sinks for residual CO_2.
Chemicals and Refining	
[EL] Electrification of thermal processes Applicable at low-to-medium temperatures; requires redesign of utilities and safety systems.	**[CC] CO_2 capture, utilization and storage** Medium-maturity option for deep reductions in hard-to-abate processes.
[H_2] **Hidrógeno verde** (Green hydrogen) Available technology, with cost and large-scale supply challenges.	**[RQ] Chemical recycling to feedstocks** Conversion of plastics/waste into feedstock; an indirect pathway to reduce virgin fossil inputs.
[EU] Electrification of end uses Electric motors, pumps and others; an area with rapid advances.	**[TI] Emerging technologies** Emerging portfolio not yet widely deployed across industry.
Pulp and Paper	
[BM] Biomass as fuel Widely used (≈40% of the mix). Potential limited by availability and sustainability.	**[CG] Efficient cogeneration** Widespread (mainly gas), adaptable to H_2 or biogas.
[EE] Efficiency and digitalization Advanced management and control systems; continuous improvement.	**[EL] Partial electrification of drying** Heat pumps and electric boilers under study; steam dependency complicates scaling.
[H_2] Hydrogen for cogeneration Possible from 2025 onwards if supply is available and costs are competitive.	**[SB] Biogenic sinks** Sustainable forest management, black liquor and recycling with a positive carbon balance

Each of these sectors has developed technical roadmaps aligned with European climate policy, setting out priority measures and implementation timelines (European Commission, 2022). Alongside these sector-specific technologies, energy efficiency measures, including operational optimization and equipment renewal, together with the use of renewable energy, remain essential tools for emissions mitigation (IEA, 2022b).



In summary, the technologies to reduce these emissions are available and market-tested, but their large-scale adoption depends on factors such as competitiveness, access to finance and regulation. These factors are analyzed in the following section.

Bottlenecks Identified 04

Bottlenecks Identified 04

Within the framework of the dialogue organized by **alinnea** as part of the working group, *bottlenecks* are understood as structural, regulatory, technical, financial, or cultural obstacles that prevent or delay the implementation of decarbonization actions by companies. These are not isolated shortcomings, but barriers which, by their nature or scale, require coordinated solutions involving multiple stakeholders. Identifying these bottlenecks makes it possible to prioritize interventions, design more effective policies, and direct resources towards the areas with the greatest potential impact on the industrial transition. This section sets out the bottlenecks identified through the dialogue process and subsequently validated with stakeholders during the working sessions.

4.1 Electricity prices in Spain and Europe higher than those of global competitors

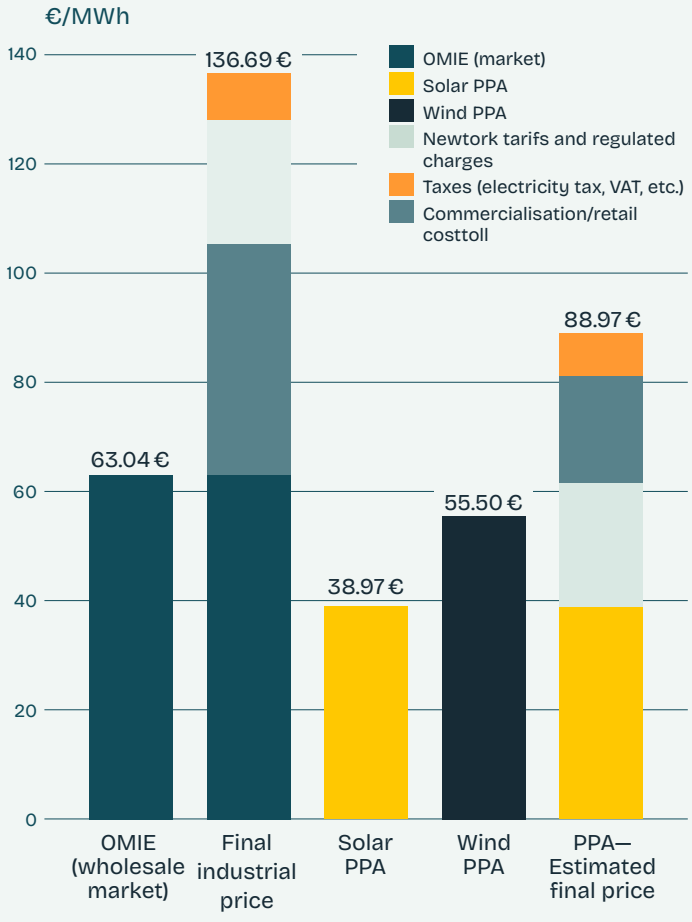
In 2024, electricity prices for industry in Spain show a significant gap between wholesale market prices and the final price paid by companies. While the wholesale market price (OMIE) stood at around €63.03/MWh, the final price for industrial consumers rose to €130.04/MWh once network tariffs, regulated charges, taxes, and retail supply costs were added, as shown in Figure 3 (OMIE, 2024; Eurostat, 2024).

Long-term bilateral contracts (PPAs) stand out in electricity price comparisons. These agreements are long-term contracts between a generator and an industrial consumer that set a stable electricity price over the duration of the contract. In 2024, long-term bilateral contracts for renewable generation offered significantly lower prices: €38.97/MWh for solar power and €55.50/MWh for wind power. However, once the same network tariffs, taxes and marketing costs are added, the estimated price of industrial supply via PPA rises to €88.97/MWh, still well below the cost of conventional supply. This gap reflects both the pressure of non-energy components on industrial electricity bills and the opportunity renewable PPAs offer to reduce costs and improve price predictability (CNMC, 2024; REE, 2024).

In an international comparison of industrial electricity costs across G20 countries, Spain is among the highest, which represents a direct competitive disadvantage for Spanish industry.

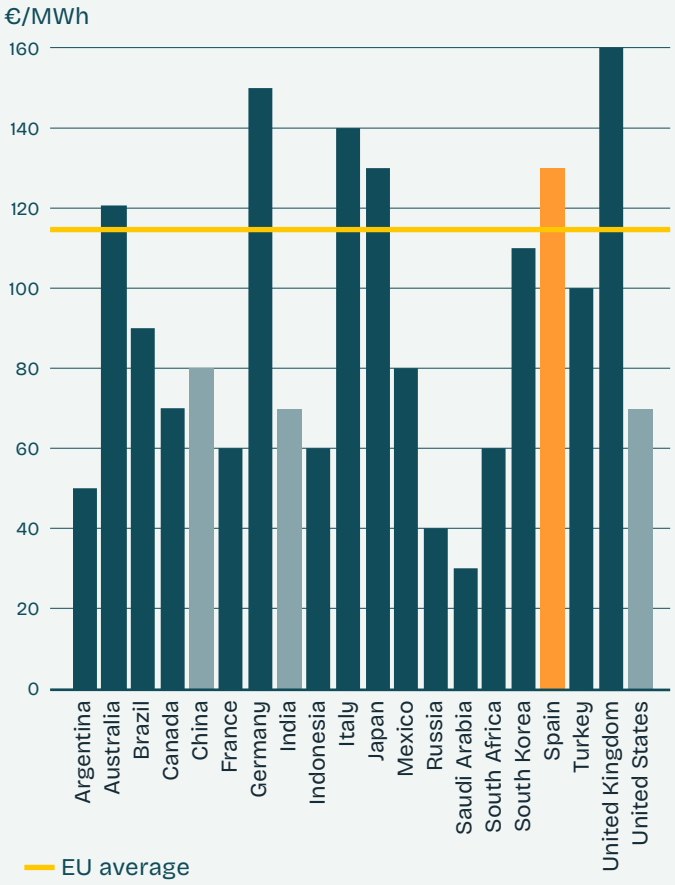
In an international comparison of industrial electricity costs across G20 countries, Spain is among the highest, at around €170/MWh during the second half of 2024, although still below the European Union average of €233/MWh (Eurostat, 2024a). Among Spain's main global competitors, economies with more carbon-intensive generation show markedly lower industrial electricity prices: the United States and India are close to €70/MWh, while China is around €80/MWh (IEA, 2024; Eurostat, 2024b). This energy-cost gap represents a direct competitive disadvantage for Spanish industry compared with economies whose electricity prices are substantially lower, as shown in Figure 4.

Figure 1.
Components of Industrial Electricity Prices: Wholesale Market vs. Power Purchase Agreements (PPAs)



Source: Own elaboration

Figure 2. Industrial Electricity Price



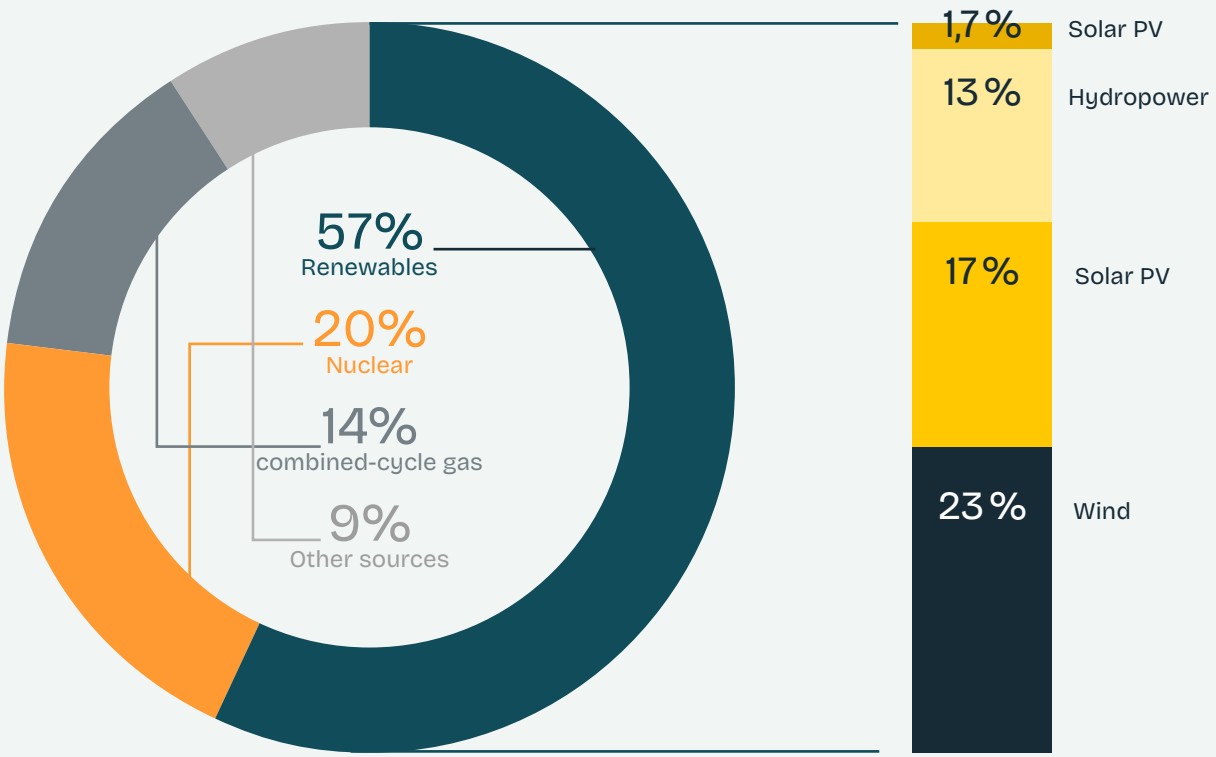
Source: CNMC a—electricity indicators bulletin, OMIE—daily market price, PPAs- RE-Source Platform (Deals Tracker 2024) and LevelTen Energy quarterly report

4.2 Limitations in energy supply and renewable storage

In a context where both the price and availability of energy are critical factors for industrial competitiveness, renewable electricity supply and storage solutions are particularly important for advancing decarbonization.

In 2024, Spain reached a historic level of clean electricity generation: 56.8% of the total electricity mix came from renewable sources, representing a 10.3% increase over the previous year (REE, 2025). The renewable fleet also reached record levels: by the end of the year, Spain had 85,144 MW of installed renewable capacity (REE, 2025). This dynamism reflects the profound transformation of the electricity system towards a greener, more competitive and more resilient model.

Figure 3.
Sources of electricity generation in Spain, 2024
Source: Own elaboration; Data: Spanish electricity grid (2025)



Photovoltaic self-consumption made a significant advance in 2024, with 9,243 GWh generated, equivalent to 3.7% of total national electricity demand (APPA, 2024). While this share may appear modest, in absolute terms it reflects a growing contribution from industry and the commercial sector to their own renewable electrification.

Overall, self-consumption is becoming an increasingly relevant mechanism for both decarbonization and cost reduction in industrial activity.

Despite this progress, energy storage remains a major constraint. In 2024, installed storage capacity reached 3,356 MW (Redeia, 2024). Storage capacity associated with self-consumption increased to 155 MWh, of which 60% corresponded to industrial installations. However, this represented only 13.55% of self-consumption systems equipped with batteries (APPA, 2024). This limited level of backup capacity restricts industry's ability to manage renewable surpluses, ensure operational continuity, and participate in emerging system-flexibility mechanisms. It is also worth noting that in February 2024 MITECO[10] referred to the current term as the "storage legislature", although progress in this area has so far been limited.

Regulatory challenges related to demand flexibility and its integration into the electricity system also persist as key bottlenecks. Circular 1/2024 of 27 September, issued by the National Commission for Markets and Competition (CNMC), establishes more flexible conditions for connecting storage facilities to the grid, recognizing that such installations not only consume electricity but also contribute to balancing supply and demand. This represents an important step towards promoting industrial electrification and facilitating the integration of renewable energy. In parallel, generators require sufficient storage capacity to retain excess renewable generation and release it during periods of higher demand. Combining demand-side flexibility with supply-side storage could have a transformative impact on the electricity system. These measures are essential for advancing industrial electrification and strengthening renewable integration, but their full potential depends on the establishment of a clear, coherent, and agile regulatory framework. In this context, in 2024 MITECO proposed a regulation to establish a capacity market within the electricity system, which has already been submitted for public consultation (MITECO, 2024f).

10 https://elperiodicodelaenergia.com/joan-groizard-idae-esta-es-la-legislatura-del-almacenamiento

4.3 Need for liquid and gaseous transition fuels

In Spain, liquid and gaseous transition fuels, renewable hydrogen, renewable gases such as biogas and biomethane, and renewable fuels, make it possible to leverage existing infrastructure and provide dispatchable energy where direct electrification is not viable. They are particularly relevant for covering the last 10 to 15% of energy demand that is most difficult to decarbonize, due to the intermittency of renewables and the specific requirements of certain industrial processes (MITECO, 2023).

For hydrogen, the official target for 2030 is to reach 12 GW of installed electrolysis capacity, promoting industrial projects and hydrogen valleys in different regions of the country (MITECO, 2023d). In renewable gases, the target for 2025 is to produce more than 10.4 TWh, strengthening supply security, circularity and fossil gas substitution in industry, cogeneration and transport (MITECO, 2022). These targets are supported by national plans and specific funding programs.

Although the technologies already exist and have been demonstrated, their large-scale roll-out depends on cost-effectiveness, clear price and demand signals, the availability of financing and a regulatory framework that facilitates integration into the energy system (IEA, 2023b). These factors will be analyzed in detail in the next section of the report.

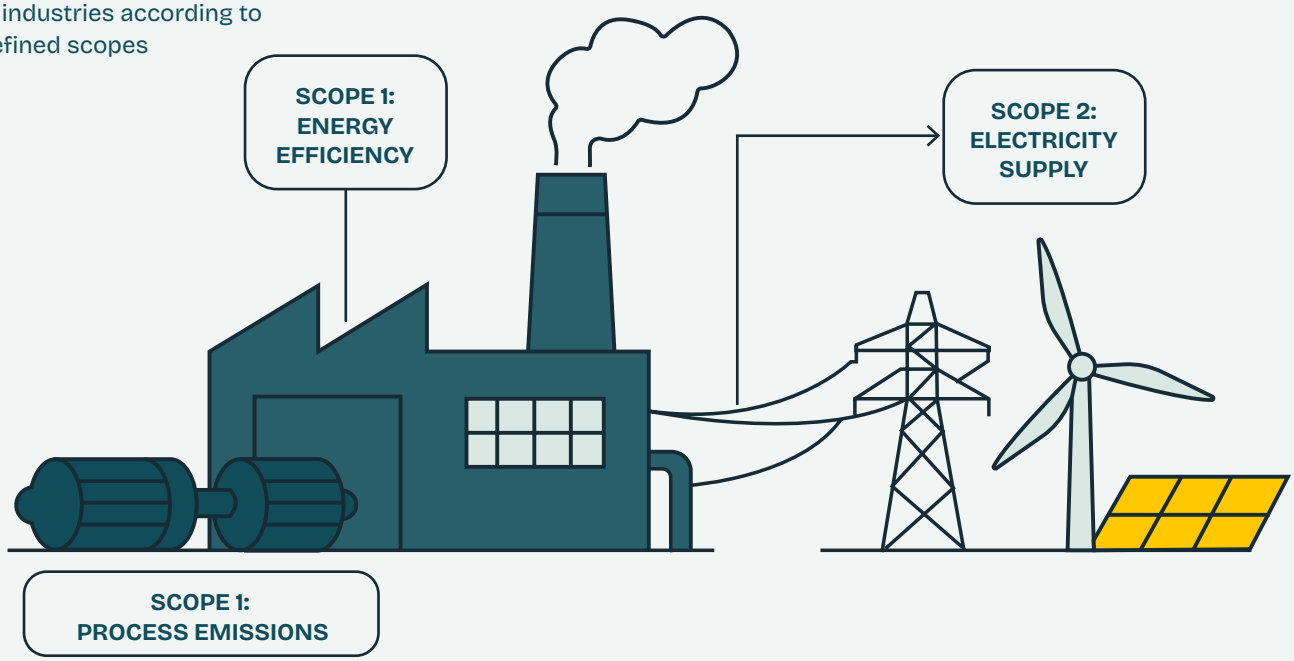
4.4 Barriers to scaling up direct GHG emission mitigation technologies

Technologies to reduce industrial emissions are available and proven; the challenge is not technical, but rather one of deployment at scale and integration with existing processes, as highlighted in section 3.4.

Emissions associated with energy consumption can be mitigated through energy management. This includes continuous measurement and verification, advanced process control, variable-speed drives, high-efficiency motors, predictive maintenance and the implementation of ISO 50001 energy-management systems (IEA, 2023d). Energy integration within processes and the electrification of heat where technically and economically feasible constitute a second set of measures to improve process energy efficiency (EC, 2022).

Thermal storage is a technology that allows energy to be stored in the form of heat for later use in industrial processes, reducing dependence on instantaneous generation and making better use of renewable electricity. In industry, this system is integrated to replace boilers and furnaces, charging the storage during hours of low demand or lower prices and releasing the heat when needed. Spain is emerging as one of the leading countries in its development and application, supported by pilot and commercial projects in sectors such as food, chemicals and paper (IEA, 2023c).

Figure 4.
Sources of GHG emissions in industries according to defined scopes



According to the report *Reaching the potential of electrothermal storage: an action plan for Spain* (The Systemic, 2024), which examines global opportunities for electrothermal storage, Spain has favorable conditions such as the price differential between electricity and gas, high industrial heat demand and abundant renewable generation. However, barriers remain, including grid delays and congestion, remuneration schemes that are not well adapted, and low familiarity with the ETS in industry.

In material-intensive sectors, emissions are concentrated in scope 1 and scope 2. In transformation sectors, scope 3 emissions predominate, requiring differentiated approaches and circular economy measures, such as increasing the recycled content of steel and aluminum or using lower-carbon inputs, since most emissions originate in the supply chain.

For electricity-intensive sectors, there are key decarbonization technologies for each one, for example:

- **Cement:** reducing the clinker[11], factor; low-GHG alternative fuels (such as biomass, biofuels, biogas and hydrogen); carbon dioxide utilization and storage (CCUS) for calcination emissions.
- **Paper and pulp:** optimization of drying; heat recovery; heat pumps; biomass boilers/efficient cogeneration; and progressive electrification of the drying process.
- **Chemicals:** electrification of process heat (e.g., electric cracking); renewable hydrogen for ammonia and derivatives; bio-based feedstocks[12] and carbon dioxide capture, utilization and storage (CCUS) to recover production emissions in intensive processes.
- **Oil refining:** deep thermal integration; hydrogen network optimization; replacement of grey hydrogen with lower-carbon hydrogen[13], furnaces/cracker electrification where feasible.
- **Steel industry:** migrating from blast furnaces to electric arc furnaces with scrap and direct reduction technology (DRI) using hydrogen; improving efficiency in casting and rolling processes; and CCUS in blast furnace routes[14].

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11 In the cement manufacturing process, clinker production—where limestone is decarbonized—is the most GHG-intensive stage ($CaCO_3 \rightarrow CaO + CO_2$). Clinker can be replaced by supplementary cementitious materials such as fly ash, steel slag, volcanic ash, calcined clays and ground limestone. These are more sustainable and cost-effective options, although their use is limited by local availability, technical standards and resistance to change in construction.

12 Bio-based raw materials are those that come from renewable biological resources (plants, animals, microorganisms or organic waste) rather than fossil resources such as oil, natural gas or coal.

13 Hydrogen is color-coded according to the energy source used in its production process and the treatment of the CO_2 emissions generated. The categories are:
i) grey hydrogen when produced from natural gas or coal, emitting CO_2 into the atmosphere;
ii) blue hydrogen with the same fossil origin but with CO_2 capture and storage;
iii) green hydrogen when electrolysis is powered by renewable electricity, with no emissions;
iv) turquoise hydrogen when produced through methane pyrolysis generating solid carbon instead of CO_2, with low emissions if renewable energy is used; and
v) pink hydrogen when electrolysis is powered by nuclear energy, which is low in emissions although not renewable.

14 The usual steelmaking processes are:
i) blast furnace (BF), where iron ore and coke are used as reducing agents;
ii) basic oxygen furnace (BOF), where pig iron and scrap are charged and pure oxygen is blown in to reduce the carbon content and obtain steel; and
iii) direct reduced iron (DRI), which replaces the blast furnace route and uses natural gas or hydrogen as a solid-state reducing agent. DRI is generally fed into an electric arc furnace (EAF). The MITECO methodology guide for calculating carbon footprints uses these standards as its methodological basis and identifies them as the most widely recognized.

4.5 Limited impact of carbon pricing on industrial decisions

In Spain, the environmental regulation that effectively shapes industrial decisions is the mandatory European Emissions Trading System (EU ETS), while voluntary markets and credits linked to land use and land-use change currently play a much smaller role in industrial investment. In fact, under the EU ETS Spain has achieved a 57.5% reduction in regulated emissions between 2005 and 2023, indicating that the regulatory–price lever works for electricity-intensive sectors such as energy, refining, cement, steel and chemicals (European Parliament, 2024).

By the end of 2023, the registry included **9,913** entries from 4,141 organizations, although the volume effectively offset remained modest in industrial terms. (MITECO, 2023e)

Spain has the MITECO Carbon Footprint, Offsetting and Absorption Projects Registry, which centralizes domestic initiatives linked to carbon sinks, mainly in forestry, in addition to registering and monitoring footprints. By the end of 2023, the registry included 9,913 entries from 4,141 organizations, although the volume effectively offset remained modest in industrial terms (MITECO, 2023e). In 2024, this trend continued: the focus remained on voluntary reduction activities, with high participation but limited uptake of effective offsetting.

However, Royal Decree 214/2025 establishes that, as of 2026, companies subject to non-financial reporting obligations, as well as public-sector entities, must calculate and publish their carbon footprint for scopes 1 and 2[15], and must also have an emissions-reduction plan. The regulation significantly expands the scope of the Registry. Although it does not oblige private companies to register, it does require them to publicly disclose key information, representing an important step in increasing transparency and visibility of emissions and mitigation plans across industry.

There are also emerging bonds linked to soil conservation and improvement. These instruments are gaining relevance in the agricultural and forestry sectors, although their application in industry remains very limited.

15 Scopes 1 and 2 of greenhouse gas emissions are defined in ISO 14064-1 (Greenhouse gases—Part 1: *Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*) and in the GHG Protocol Corporate Standard. Scope 1 corresponds to direct emissions from sources owned or controlled by the organization, while scope 2 refers to indirect emissions associated with the generation of electricity, heat or steam purchased and consumed by the organization.

4.6 Uneven adaptability between large industries and SMEs

The scale of production, whether the company is large, medium or small, together with its geographical location[16], access to electricity grids and industrial specialization, decisively influences the adoption of clean technologies.

Large companies tend to have specialized technical teams and internal structures dedicated to sustainability, as well as greater regulatory stability due to their exposure to international markets. This enables them to plan and implement decarbonization investments more quickly and with greater certainty (MITECO, 2023a).

The situation is different for medium-sized companies. Many lack staff dedicated exclusively to environmental or energy efficiency matters, and limited knowledge of available technologies constrains the identification of opportunities. In addition, fragmented information and the absence of clear channels for accessing technical knowledge create another barrier. Decarbonization often occurs in an ad hoc manner, driven by customer requirements or access to specific incentives, rather than through a sustained internal strategy (MITECO, 2023a). In this regard, the report *Climate Action in Spanish Companies 2024* (Alinnea, 2024) notes that most companies act primarily in response to regulatory or reputational pressures, and that 59.4% acknowledge that their customers do not demand sustainable products nor are they willing to pay more for them. Operational continuity and business growth are usually prioritized, with sustainability investments only being undertaken when they are economically viable in the short term.

While innovation is often integrated into the competitive strategy of large corporations, small and medium-sized enterprises tend to adopt a more reactive stance.

Finally, corporate culture plays a role. While innovation is often integrated into the competitive strategy of large corporations, small and medium-sized enterprises tend to adopt a more reactive stance: they innovate or adopt new technologies only when strictly necessary. Initiatives such as the Q-Zero Alliance play an important role by disseminating information and offering spaces for exchange so that these companies can make informed decisions (Q-Zero Alliance, 2024).

This pattern, combined with resource and capacity constraints, slows the adoption of decarbonization solutions and makes more active support necessary from public policies, sector associations and shared knowledge platforms (IDAE, 2024a).

16 In Spain, geographical location is shaped by factors such as:
i) the concentration of industrial hubs or clusters, for example steel in Asturias and the Basque Country, cement in Aragon and ceramics in Castellón;
ii) the existence of regional legislative frameworks, as some regions have their own decarbonization strategies; and
iii) the availability of natural resources that facilitate self-generation of renewable energy.

4.7 Taxation imbalances affecting competitiveness and decarbonization

Energy taxation has a direct influence on industrial decarbonization decisions. In Spain, the fiscal burden on electricity and other forms of energy consumption, which includes taxes, network charges and regulated levies, increases companies' operating costs. In addition, energy consumption can affect the calculation of the Impuesto sobre Actividades Económicas (IAE). Reducing energy consumption therefore not only lowers electricity bills, but also reduces associated fiscal costs, creating an additional economic incentive to invest in energy efficiency and low-carbon technologies.

At the same time, medium-sized companies are increasingly affected by non-financial corporate reporting requirements that oblige large and listed companies to disclose detailed information on their environmental, social and governance (ESG) impacts, including scope 1, 2 and 3 emissions[17] (Directive (EU) 2022/2464 CSRD). As a result, large companies request emissions data and evidence of reductions from their suppliers, often SMEs, creating indirect pressure on them even though general climate regulation does not impose direct reduction obligations on smaller firms.

Large companies, which are required to report their scope 3 emissions, pass these requirements on to their suppliers and value-chain partners, requesting carbon footprint data and evidence of reductions. This generates indirect but growing pressure for smaller companies to adopt decarbonization measures and improve environmental performance (Directive (EU) 2022/2464 CSRD).
In Spain, although the CSRD is still in the transposition phase, Royal Decree 214/2025 on carbon footprint registration has strengthened the national climate-information framework. This regulation replaces the previous Royal Decree 163/2014 and transforms its voluntary regime into a partially mandatory system by establishing, for the first time, requirements for calculating, publishing and planning emission reductions for certain organizations, including state public-sector entities and companies covered by Law 11/2018 on non-financial information. It also expands the scope of the register by requiring the preparation of reduction plans with a minimum five-year horizon—applicable from 2026—, making carbon footprints public and allowing the inclusion of new categories such as event footprints and absorption projects across different biological sinks. However, this extension of the national framework does not yet match the scope of the CSRD, which will cover a wider range of companies, impose the application of European Sustainability Reporting Standards (ESRS) and require independent external assurance of published information.

17 Scopes 1 and 2 as described in Note 4. Scope 3 includes indirect emissions across the value chain, both upstream from suppliers and downstream from product use, transport, and end-of-life.

Finally, the EU Taxonomy provides a common framework for defining which economic activities can be considered sustainable for financial purposes (Regulation (EU) 2020/852).

Used by investors, banks and public administrations, this framework conditions access to green finance and related incentives. In this context, Spanish industries seeking support through European funds or green loans must demonstrate that their projects comply with the taxonomy's technical screening criteria, which include substantial emissions reductions and, in some cases, improvements in energy efficiency or renewable-energy use.

This not only guides investment decisions towards projects aligned with decarbonization but also requires companies to plan ahead and rigorously document progress in order to access competitive financing. Alignment with the EU Taxonomy has therefore become a key condition for accessing much of the national and regional public funding earmarked for industrial decarbonization (Regulation (EU) 2020/852).

4.8 Fragmentation and complexity in public funding lines

In Spain, there are several sources of public funding at national and regional level that support industrial decarbonization. The main ones include:

* **Energy Saving Certificates (CAE):**
  Since January 2023, these certificates allow certification of measurable energy savings (kWh) from efficiency improvements such as lighting, insulation or equipment renovation. These certified savings can be sold or used to meet savings obligations (MITECO, 2023).

* **ICO Green Line:**
  Financing program with a €22 billion budget for energy efficiency, renewable energy, industrial decarbonization and circular economy projects (ICO, 2023).

* **IDAE (Institute for Energy Diversification and Saving):**
  Manages national and EU support programs for energy efficiency and low-carbon technologies, with a particular focus on the industrial sector (IDAE, 2024b).

* **National Energy Efficiency Fund (FNEE):**
  Linked to the CAEs, it finances support lines and energy saving projects across different sectors, including industry (MITECO, 2023).

* **PERTE for Industrial Decarbonization:**
  Initiative under the Recovery Plan that mobilizes investment to modernize industry, supporting actions in energy management, electrification, heat recovery, renewable hydrogen, efficiency and the circular economy (MITECO, 2023).

* **ERDF funds:**
  Channel European resources towards energy and industrial transition projects in the autonomous communities (European Commission, 2021).

* **Just Transition Fund:**
  Targeted at territories most affected by the closure of carbon-intensive activities, supporting their industrial and labor reconversion (MITECO, 2022).

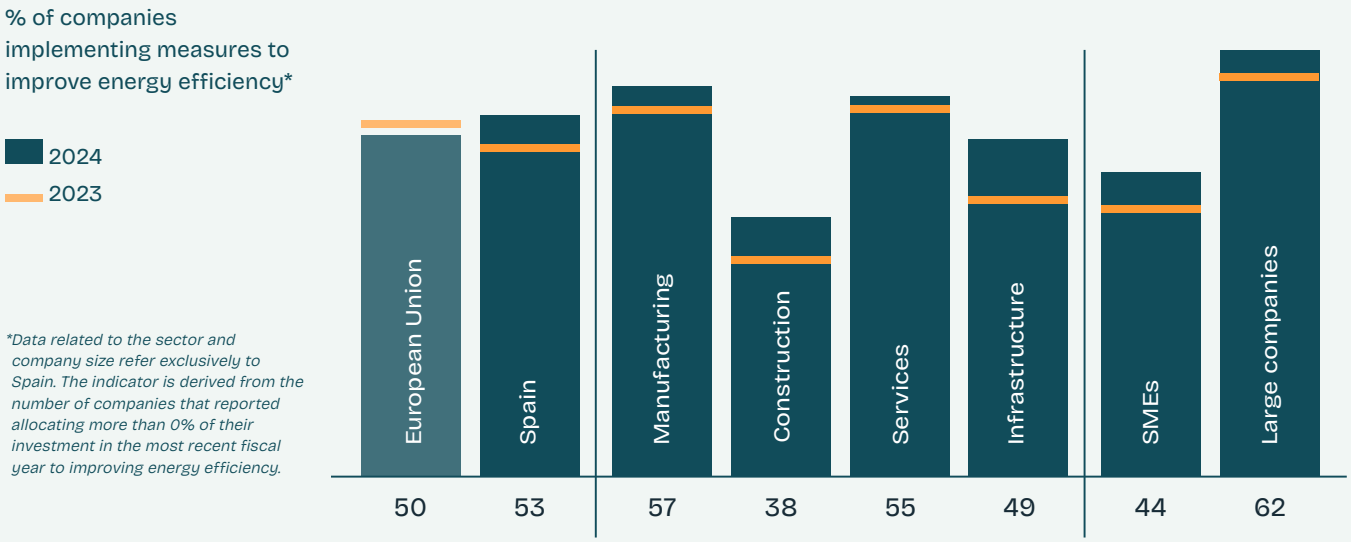
Access to these funding sources is formally available, but the process of submitting projects, obtaining certifications, and complying with technical requirements is often complex, particularly for industrial SMEs.

Access to these funding sources is formally available, but the process of submitting projects, obtaining certifications, and complying with technical requirements is often complex, particularly for industrial SMEs. It entails preparing detailed technical documentation, coordinating with bodies such as IDAE, navigating regulatory procedures, and demonstrating the expected return on investment. Together, these demands impose a significant burden in terms of time, resources, and operational capacity, which can deter participation even when the instruments are explicitly designed to maximize impact.

In the private sector, financing for industrial decarbonization is available through instruments offered by entities such as the European Investment Bank (EIB) and commercial banks, including green credit lines, syndicated loans and sustainability-linked products.

However, several limitations still hinder effective uptake. These include restricted access to credit for companies with lower solvency, a shortage of projects considered bankable by meeting the financial sector's profitability and risk criteria, and a disconnect between financiers' expectations and the technical and operational realities of industrial companies. This gap reduces the effective flow of capital to industrial decarbonization projects, even when interest and funding are available (Green Banking and Finance, EIB 2023).

Figura 5.
Spanish companies' investment in energy efficiency (EIB, 2024)



*Data related to the sector and company size refer exclusively to Spain. The indicator is derived from the number of companies that reported allocating more than 0% of their investment in the most recent fiscal year to improving energy efficiency.

Fuente: BEI, 2024

4.9 Occupational risks and the need for a just transition in decarbonization

Industrial employment plays a major role in Spain's economy. In 2024, approximately 3,323,000 people were employed in the industrial sector (INE, 2024b), underscoring its importance within the labor market. Employment vulnerability is particularly pronounced in the most carbon-intensive industrial sectors, such as steel, cement, and refining.

It is essential to anticipate the transformation through training and reskilling policies and through robust social dialogue involving trade unions, companies and public administrations.

There is a real risk of job losses if the ecological transition is not planned in advance. For this reason, it is essential to anticipate the transformation through training and reskilling policies and through robust social dialogue involving trade unions, companies and public administrations. For example, in the steel sector, Comisiones Obreras is examining the three possible technological pathways (see footnote 4) and proposing a model that combines renewable hydrogen, renewable electricity and the use of the country's consolidated electric arc furnace network to avoid industrial relocation (CCOO, 2025). In addition, new technology deployment may entail new occupational risks that must be assessed in detail to determine necessary preventive measures.

Territorial observatories, such as the Institute for a Just Transition (ITJ), play a key role. Their mandate is to identify measures that ensure fair treatment for the workers and territories most affected by decarbonization, minimizing negative impacts on employment and depopulation. Although there are still no direct figures on decarbonized industrial employment, the analytical framework is under development, supported by trade union participation and the creation of dedicated monitoring networks.

Proposals 05

Proposals 05

5.1 Improving access to and storage of renewable electricity

Description

Renewable electricity supply is becoming increasingly important for industry, yet it currently faces two major constraints: congestion in grid access and a shortage of storage capacity. Although Spain reached a renewable generation share of 56.8% in 2024 (REE, 2024b), limited connection capacity, insufficient grid planning, and delays in reinforcing grid connection nodes constrain the effective use of this resource. In addition, only 13.5% of industrial self-consumption installations are equipped with batteries (APPA, 2024), which further limits flexibility. For industrial companies, these barriers translate into higher costs and reduced security of supply. The proposal therefore seeks to deploy storage, reinforce grid infrastructure, and ensure flexibility mechanisms that guarantee sufficient volumes of renewable electricity at competitive prices and with reliable quality.

It also calls for a review of the remuneration framework for electricity distribution and for clearer, more stable regulatory signals to incentivize private investment in grid infrastructure and storage. Energy efficiency should be considered a prerequisite and a complementary pillar alongside storage solutions. The proposal also includes revisiting the current link between investment levels in electricity distribution and GDP growth, allowing for more flexible and forward-looking planning of future industrial demand.

Objective

Ensure an abundant, competitive and secure supply of renewable electricity that supports the industrial sector's energy transition. The proposal also seeks to ensure that deployment takes place under criteria of participation and transparency, incorporating the voice of workers, trade unions and civil society to reinforce social acceptance and industrial consensus.

Improve access to and storage of renewable electricity for industry. Promote the expansion of grid infrastructure, the development of storage solutions and the creation of flexibility mechanisms that support industrial electrification.

It also aims to strengthen social acceptance of energy infrastructure through educational and institutional communication campaigns, inspired by successful circular economy experiences, to help build public trust and reduce local opposition to renewable energy projects.

Measures

Regulatory and governance

a. Review electricity distribution remuneration criteria to ensure that private investment in the grid and in storage achieves an adequate return. This review should be coordinated with the CNMC and include a flexible planning framework decoupled from the constraints imposed by GDP growth.

b. Designate grid and storage projects as strategic and social interest initiatives. Use regional best practices, such as Decree-Law 12/2025 of 3 June in Catalonia, which allows projects to be treated as priority social interest in order to streamline permitting.

c. Review and accelerate industrial grid access and connection permits through a one-stop shop and maximum processing deadlines.

d. Expand connection capacity and publish clear timetables and prioritization criteria, giving preference to projects that incorporate storage.

e. Define and remunerate energy supply flexibility services to enable additional revenue streams.

Infrastructure and technical planning

a. Accelerate grid reinforcements at critical capacity bottlenecks, ensuring transparency in capacity maps.

b. Update transmission and distribution network planning with forward-looking industrial electrification scenarios, incorporating biennial review mechanisms.

Financial and economic incentives

a. Develop and implement incentives for large-scale energy storage and demand flexibility solutions.

b. Create financing products tailored to renewable energy and storage investments for SMEs and large industrial companies.

c. Promote public guarantee funds to reduce the financial risk associated with industrial storage investments.

Technological and industrial

a. Collaborate with the industrial sector to offer contracts and services that optimize renewable electricity use, including storage and peak demand management.

b. Develop and transfer innovative storage solutions adapted to different scales and industrial processes.

c. Install on-site self-consumption and storage solutions to reduce costs and exposure to price volatility.

d. Participate in pilot projects on energy flexibility to optimize consumption patterns.

Participate in pilot projects on energy flexibility to optimize consumption patterns.

e. Prioritize thermal storage for steam and process heat, charging during hours of high renewable generation or off-peak periods.

f. Tailor solutions to the consumption profile of each industrial sector, prioritizing those with the greatest impact and technical viability. Adapt solutions to company size: on-site self-consumption and storage for SMEs, and large-scale grid and storage systems for large industries.

g. Reduce the mismatch between PPA production and actual consumption through electrical or thermal storage. Incorporate flexibility criteria based on temperature ranges and load patterns linked to industrial processes.

Social, communication and knowledge transfer

a. Promote support programs for collective self-consumption, facilitating access to industrial energy communities and simplifying administrative procedures.

b. Develop public education and communication campaigns to strengthen social acceptance of renewable energy and storage projects.

c. Facilitate technology transfer workshops and the dissemination of good practices on hybrid self-consumption models

Stakeholders involved

Ministry of Finance

a. Designs tax incentives and financial benefits for industrial companies investing in energy storage and self-consumption.

b. Works with the financial sector to promote public guarantee funds that reduce investment risks.

Ministry for Ecological Transition and Demographic Challenge

a. Develops regulatory frameworks that promote investment in storage and flexibility infrastructure, declaring projects of strategic and social interest.

b. Leads programs supporting collective self-consumption and industrial energy communities, incorporating one-stop shops to simplify access and connection procedures.

c. Coordinates grid and storage planning with transparency criteria, ensuring that schedules align with industrial needs.

d. Adapts support programs to include storage solutions tailored to industrial requirements (IDAE).

e. Collaborates with technology centers to promote innovation projects (IDAE).

Ministry of Industry and Tourism

a. Integrates storage and self-consumption solutions into industrial policy, aligning calls for support with competitiveness objectives.

b. Promotes industrial participation in flexibility pilot projects.

c. Includes energy efficiency and storage as priority areas in industrial competitiveness and digitalization policies.

National Commission for Markets and Competition and Red Eléctrica de España

a. Publish prioritization criteria and connection schedules, giving preference to projects that incorporate storage.

b. Define and remunerate flexibility services provided by industry, enabling new income streams.

c. Reinforce the grid at critical capacity bottlenecks and ensure transparent access-capacity maps.

Autonomous Communities and Local Authorities

a. Deploy programs supporting collective self-consumption and industrial energy communities within their climate action plans.

b. Facilitate licenses and permits in coordination with MITECO through one-stop shops, reducing deadlines and administrative burdens.

c. Promote pilot projects tailored to the needs of the regional industrial fabric.

Financial sector

a. Develop financing products specifically designed for industrial storage and self-consumption investments, adapted to both SMEs and large companies.

b. Participate in public guarantee funds to reduce the risk associated with storage and demand-flexibility investments.

Distribution and retail electricity companies

a. Develop contracts that integrate storage and flexibility into industrial electricity supply.

b. Act as facilitators for industrial SMEs, offering turnkey solutions for self-consumption and storage, drawing on successful practices in other energy sectors.

Technology centers

a. Develop and transfer storage solutions tailored to different industrial processes.

b. Share best practices through workshops and innovation programs, supporting the adoption of replicable models across sectors.

Industrial companies

a. Implement on-site self-consumption and storage solutions to reduce costs and exposure to price volatility.

b. Participate in energy flexibility pilot projects, prioritizing thermal or electrical storage depending on production processes.

c. Optimize consumption through energy management technologies and use technology-transfer and financing programs.

d. Integrate continuous energy efficiency plans as the first stage of their electrification strategies.

Trade unions and civil society

a. Take part in designing and monitoring industrial storage and self-consumption programs, ensuring that the transition is fair and equitable.

b. Participate in energy governance observatories together with administrations and companies.

Possible barriers

a. Insufficient alignment between grid planning and industrial electrification, delaying new demand connections and limiting storage effectiveness.

b. Low returns on investments in storage and flexibility, which may discourage private capital.

c. Territorial disparities in grid capacity access and support programs.

d. Administrative complexity in calls for funding and licensing procedures.

e. Public opposition to new energy projects if not managed with transparency and early engagement.

f. Lack of coordination among institutional stakeholders and the absence of a unified monitoring framework for grid and storage projects.

g. Risk of imbalance between electricity supply and demand, where generation interests are prioritized without a clear justification based on industrial demand. This could result in higher costs or pressure to increase generation remuneration in order to retain investment, compared with more competitive European markets

5.2 Reducing the final price of electricity for industrial use

Description

High electricity prices are one of the main barriers to competitiveness and investment in industrial decarbonization. In 2024, the final cost for industry in Spain was around €130/MWh, above the EU average (€115/MWh) and well above global competitors such as the United States or India (€70–80/MWh). Although renewable PPAs offer lower prices (€39–55/MWh), once network tariffs and regulated charges are added, their cost rises to around €90/MWh. The proposal therefore seeks to reduce non-energy costs, improve access to renewable electricity and provide price stability, so that Spanish industry can compete on a level playing field.

Objective

To ensure predictable and affordable energy costs that strengthen the competitiveness and decarbonization of the industrial sector. The measures must also ensure consistency with the European Carbon Border Adjustment Mechanism (CBAM) and provide stable long-term regulatory certainty, which is crucial for investor and industry confidence.

Measures

Regulatory and fiscal

a. Review the tariff structure, network tariffs and regulated charges to adapt them to the needs of energy-intensive sectors, in particular, removing revenue-raising charges not linked to actual system costs and aligning industrial bills with European best practices.

b. Explore fiscal mechanisms and compensation to reduce costs, including partial exemptions from energy taxes, and review tax instruments affecting electricity consumption (VAT, electricity taxes and IAE) to reflect the reality of energy-intensive sectors.

c. Coordinate fiscal and energy policy so tax and tariff reforms are integrated into a long-term industrial strategy that combines competitiveness and decarbonization, ensuring that the measures' benefits are effectively passed on to industrial consumers.

Energy planning and market governance

a. Align renewable energy auctions with territorial and grid planning, avoiding concentrations that exacerbate congestion or increase prices in specific areas.

b. Include trade unions, business associations and civil society in tariff policy design, ensuring transparent, multi-stakeholder governance consistent with just transition principles.

Market instruments and energy procurement

a. Promote long-term supply contracts (PPAs) between producers and industrial consumers, encouraging standardized models and transparent contractual frameworks.

b. Encourage the creation of energy purchasing groups, organized by clusters or industrial sectors, to negotiate improved access to PPAs and more competitive pricing.

c. Reduce the mismatch between PPA generation and actual consumption through energy hedging solutions, including electrical or thermal storage and complementary supply guarantee contracts.

Technological support and energy efficiency

a. Adapt technological solutions for heat supply to different industrial temperature ranges, ensuring that prices reflect the specific characteristics of thermal and electrical processes.

b. Incorporate circular economy criteria across incentives and auctions, valuing projects that optimize both energy and material resource use.

Financial and economic support

a. Prioritize public and financial support for the industrial sectors most exposed to international competition and with the highest energy consumption, differentiating instruments according to energy intensity and degree of electrification.

b. Promote public guarantee funds and dedicated credit lines to facilitate access for industrial SMEs to competitive energy contracts and PPAs, reducing financial risk.

c. Develop training and technical advisory programs for SMEs and industrial clusters on energy procurement, risk management, and participation in auctions or collective purchasing groups.

Competitiveness and international industrial policy

a. Ensure that decarbonization measures maintain competitiveness vis-à-vis international producers not subject to the same environmental requirements, avoiding carbon leakage and the loss of industrial investment.

Stakeholders and implementation context

Ministry of Finance and Public Service

a. Modify tax instruments to reduce final energy costs.

b. Design tax compensation mechanisms for electricity-intensive sectors and coordinate with the European Commission to ensure compatibility with State aid rules.

c. Review electricity bill charges used for revenue-raising purposes and coordinate with MITECO to define a tax framework that incentivizes industrial energy efficiency.

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Review the tariff structure and the network charges applied to industry.

b. Design and launch specific renewable energy auctions to ensure direct supply to industrial consumers.

c. Define mechanisms to maintain competitiveness vis-à-vis international producers that are not subject to equivalent requirements.

d. Align auctions with actual industrial demand and prevent generation incentives from causing imbalances in the final price or shifts in investment towards other European markets.

Autonomous Communities and Local Authorities

a. Coordinate with the General State Administration in applying differentiated fiscal and tariff measures for energy-intensive industries.

b. Facilitate access for companies to support programs linked to renewables and self-consumption.

c. Promote the creation of regional energy service windows that inform SMEs and industrial clusters about PPAs, auctions and cost-saving tools.

National Commission for Markets and Competition (CNMC) and Red Eléctrica de España (REE)

a. Regulate industrial renewable energy auctions.

b. Establish a stable framework so that energy storage and flexibility can generate revenue streams.

Industrial companies (SMEs and large companies)

a. Negotiate long-term supply contracts (PPAs) to secure stable prices.

b. Create energy purchasing groups at sector or cluster level to improve access conditions.

c. Implement electrical or thermal storage solutions to reduce mismatches between renewable production and actual consumption.

Financial sector (commercial banks, public banks, green investment funds)

a. Develop guarantees and credit lines tailored to SMEs to facilitate access to PPAs and competitive energy contracts.

Industrial energy cost observatory

a. Continuously monitor the evolution of energy tariffs and prices.

b. Publish transparency reports and propose adjustments in coordination with government and industry.

c. Include trade unions, business associations and civil society to ensure legitimacy and social acceptance.

Possible barriers

a. Political complexity in modifying taxes and regulated network tariffs.

b. Risk that auctions are poorly designed and distort the market.

c. SMEs' mistrust of complex or long-term financial instruments.

d. International volatility of energy prices, which may put pressure on outcomes.

5.3 Facilitating access to direct emission mitigation technologies (scope 1)

Description

Direct emissions from industry, known as scope 1, come mainly from the combustion of fossil fuels and specific production processes, such as cement calcination or the use of steel furnaces. Although mature and emerging technologies exist, from fuel substitution to CO_2 capture, their adoption is limited by high costs, technological uncertainty and insufficient technical support.

The working group also highlighted the need to differentiate technologies by sector: green hydrogen is essential for refining, fertilizers and steelmaking, but it is not efficient for low and medium temperature heat, where electrification or biomethane are preferable. The proposal seeks to accelerate the adoption of these technologies using sector-specific criteria, financial support and technical assistance, while strengthening the role of the circular economy and green public procurement as drivers of demand.

Objective

To accelerate the deployment of technologies that reduce direct emissions in industrial processes. To adapt solutions to the specific characteristics of each sector and provide technical and financial support. The ultimate goal is to decarbonize the most carbon-intensive industrial activities in a viable and competitive manner.

Measures

Innovation, demonstration and technological scaling

a. Finance innovation and demonstration projects for direct emissions mitigation, and support their scale-up to industrial deployment, prioritizing sectors with high carbon intensity.

b. Establish dedicated support lines for technological conversion and process engineering to facilitate the adaptation of existing industrial plants to low-emission technologies.

c. Connect national programs with strategic European projects (IPCEI, Horizon Europe, Innovation Fund) to leverage funding and accelerate technology transfer and scaling.

d. Create an Industrial Climate Action Fund to co-invest with the private sector in pilot projects for CO_2 capture, renewable hydrogen and biomethane, promoting collaboration between companies and technology centers.

Technical assistance, support and training

a. Provide technical assistance and feasibility studies to support the selection of the most appropriate technologies for each industrial process and temperature range.

b. Establish sector-based support services and networks of expert advisers to assist SMEs in the preparation, management and implementation of emissions-mitigation projects.

c. Design technical training and reskilling programs, in collaboration with technology centers and universities, to strengthen capabilities in low-carbon technology operation and maintenance.

d. Review companies' internal processes, identify opportunities for technological substitution, and develop investment and training plans, ensuring that energy efficiency is treated as a prerequisite for fuel substitution.

Energy efficiency and industrial management

a. Implement energy efficiency solutions that reduce consumption and optimize energy resource use in industrial processes before undertaking substitution investments.

b. Develop or update sectoral roadmaps that prioritize technologies according to temperature ranges, carbon intensity and economic feasibility, establishing concrete emission reduction targets.

Regulatory framework and institutional governance

a. Define stable regulatory frameworks and uniform eligibility criteria for mitigation technologies, providing long-term visibility for industrial investment.

b. Strengthen interministerial coordination through a permanent committee to ensure consistency between industrial, energy and climate policy.

c. Direct public resources towards high-impact sectors and technologies, avoiding duplication and ensuring efficient use of funds.

Financial instruments and economic support

a. Simplify public financing instruments through streamlined procedures, improved coordination between administrations, and prioritization of SMEs and strategic sectors.

b. Design tailored financial instruments, including credit lines, guarantees and co-investment mechanisms, to facilitate industrial companies' access to financing for mitigation and technological reconversion projects.

c. Incorporate the circular economy as a cross-cutting principle in support and financing instruments, prioritizing projects that optimize both energy use and material resources.

Circular economy and green product markets

a. Promote circular economy solutions linked to industrial processes, encouraging recycling, by-product reuse and industrial symbiosis.

b. Integrate circularity criteria into mitigation strategies, promoting material reuse and substitution with lower-carbon inputs, particularly in processing industries where indirect (Scope 3) emissions predominate.

c. Establish green public procurement criteria for industrial products (steel, cement, fertilizers), incentivizing demand for decarbonized materials and aligning criteria with the European taxonomy.

Emerging energy markets and vectors

a. Include biomethane in strategies to replace natural gas for high-temperature processes, ensuring its integration into regional industrial and energy plans.

b. Promote the development of national and regional markets for green hydrogen and biomethane, establishing certification systems, supply contracts and sectoral prioritization mechanisms.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Funding for innovation and demonstration projects in CO_2 capture, biomethane and electrification of industrial processes.

b. Creation of specific support lines for technological conversion and process engineering.

c. Inclusion of green public procurement criteria for steel, cement and other high-carbon-footprint materials.

Interministerial coordination committee

a. Prioritize technologies by sector and industrial process, avoiding overlaps in financial support and regulation.

b. Coordinate action between ministries and with social partners.

c. Ensure that sectoral roadmaps are aligned with national industrial and energy policy.

Autonomous Communities and Local Authorities

a. Integrate biomethane and other renewable alternatives into regional energy plans.

b. Apply green public procurement criteria in regional and local construction and infrastructure projects.

Technology centers

a. Provide technical assistance and feasibility studies to guide technology selection by sector.

b. Develop and update sectoral roadmaps, prioritizing technologies according to temperature ranges and economic viability.

c. Promote circular economy solutions linked to industrial processes (recycling, by-product reuse, industrial symbiosis).

Industrial companies

a. Evaluate internal processes and develop investment plans for ow-carbon technologies.

b. Prioritize renewable hydrogen only in sectors where no viable alternatives exist.

c. Implement energy efficiency measures as a preliminary step to fuel substitution.

d. Integrate circularity criteria into inputs and materials, with particular emphasis on indirect emissions (scope 3).

Financial sector

a. Mobilize co-investment and green capital funds for renewable hydrogen, CO_2 capture and biomethane projects.

b. Design financing instruments tailored to SMEs to facilitate their access to industrial mitigation projects.

Possible barriers

a. High Initial costs of emerging technologies such as hydrogen and CO_2 capture.

b. Limited availability of biomethane and green hydrogen relative to potential demand.

c. Regulatory uncertainty regarding eligibility and remuneration criteria.

d. Difficulty for SMEs to access technical and financial capacities.

e. Unequal competition between sectors, as some processes are easier to electrify than others, generating a risk of inefficient resource allocation.

5.4 Promoting the transfer of technical knowledge and best practices

Description

Access to technical knowledge and proven experience is essential for industry to advance in its transition. However, a gap persists between large companies and SMEs: while the former have internal resources and a greater capacity for rapid learning, the latter face higher barriers when it comes to identifying viable technologies and replicating solutions. The working group highlighted the need to structure national knowledge platforms, sectoral consortia, and a cultural shift within SMEs, so that decarbonization is perceived not only as a regulatory obligation but also as an opportunity to enhance competitiveness.

Objective

The ultimate goal is to build replicable capabilities that accelerate the uptake of low-carbon solutions across the industrial sector. This objective should also include coordination between national, regional, and private initiatives, in order to avoid duplication and ensure a shared reference framework that facilitates adoption across the entire territory.

Measures

Knowledge platforms and networks

a. Finance and consolidate national platforms for the exchange of technical information and successful case studies, accessible to companies, public administrations and technology centers.

b. Promote a national platform of technologies and solutions, differentiated by industrial sector, to serve as a reference for identifying decarbonization options applicable to each activity.

c. Participate in national and international knowledge-exchange networks, contributing practical experience and learning from recognized reference cases.

Coordination and standardization

a. Establish coordination mechanisms between national and regional platforms to avoid duplication and ensure complementarity between initiatives.

b. Define an interoperability protocol for national and regional platforms—including metadata, sector taxonomy and biannual updates—to ensure consistent and up-to-date content.

c. Develop sectoral consortia to document and disseminate good practices and impact-measurement methodologies.

d. Apply the criteria established by the European taxonomy to identify industrial products that meet green requirements, facilitating their inclusion in public procurement and sustainable financing schemes.

Training, capacity building and knowledge transfer

a. Promote sectoral training programs in collaboration with universities, technology centers and business associations, tailored to the needs of each sector.

b. Organize workshops, conferences and technical dialogues—such as those promoted by alinnea—to disseminate results and share experience.

c. Hold sectoral knowledge-transfer workshops focused on practical cases and replicable technologies that facilitate peer learning among companies.

Monitoring and cultural shift

a. Define monitoring indicators to measure business participation, the replicability of solutions and the results achieved.

b. Promote an internal cultural shift, especially within SMEs, so that sustainability is seen as an opportunity for competitiveness and long-term integration into the value chain.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Funding and coordination of national platforms for sharing technical information and case studies.

b. Support for a national platform that classifies technologies and solutions by industrial sector, ensuring alignment with decarbonization plans.

Ministry of Universities / Ministry of Education and Vocational Training (in coordination with MITECO)

a. Development of sectoral training programs in collaboration with universities, technology centers and business associations.

b. Inclusion of industrial decarbonization content in formal education and continuing education pathways.

Autonomous Communities and Local Authorities

a. Implementation of regional training and dissemination initiatives in partnership with universities and sectoral associations.

b. Facilitation of the participation of local SMEs in national knowledge-exchange platforms.

Technology centers and sectoral associations

a. Creation of sectoral consortia to document and disseminate good industrial practices.

b. Definition of harmonized methodologies to classify industrial products according to green criteria and facilitate access to public procurement schemes.

c. Organization of sector-specific workshops, conferences and technical dialogues involving companies and public administrations.

Industrial companies

a. Active participation in knowledge-exchange networks, contributing practical experience.

b. Promotion of internal cultural change, particularly within SMEs, to view sustainability as an opportunity for competitiveness and long-term integration in the value chain.

Social partners (trade unions and civil society):

a. Participation in the design and governance of knowledge platforms.

b. Contributing to the dissemination of best practices in labor and social sustainability.

c. Ensuring that initiatives incorporate a just transition perspective in the design and governance of knowledge platforms.

Possible barriers

a. Limited capacity of SMEs to allocate time and resources to training activities.

b. Lack of a common framework to assess which practices are genuinely effective or replicable.

c. Risk of duplication of efforts if platforms are not coordinated across national and regional levels.

d. Difficulty in shifting cultural perceptions in parts of the SME landscape, where decarbonization is still viewed as an added cost.

5.5 Facilitating access to technical assistance for green investment projects

Description

Many companies, especially SMEs, lack the technical capacity to prepare green investment projects that are attractive to public and private financiers. Experience shows that while large companies have internal engineering and finance teams, SMEs rely on external advisory services and face difficulties in meeting bankability[18] requirements. To bridge this gap, this proposal seeks to consolidate technical assistance services, support SMEs in project design, and facilitate project aggregation in order to reach sufficient scale and secure competitive financing conditions.

Objective

Provide technical assistance for the preparation of green investment projects. Consolidate technical and financial support services, support SMEs, and facilitate project aggregation. The aim is to increase the number of bankable projects that access public and private financing in a timely and effective manner. The objective should also strengthen coordination between public administrations and financial institutions, simplifying requirements and providing greater certainty for SMEs.

18 The requirements include guarantees, reporting structures, and minimum investment thresholds.

Measures

Technical assistance and support

a. Consolidate technical and financial support services to accompany companies throughout the design, development and submission of green investment projects.

b. Coordinate existing technical assistance services—public administrations, business associations and technology centers—to avoid duplication and ensure a one-stop shop for companies.

c. Create dedicated advisory programs for SMEs, tailored to their scale, needs and sector of activity.

d. Provide feasibility studies, technology assessments and business model advisory services to support decision-making and improve the technical quality of project proposals.

e. Promote participation in training and mentoring programs on project management and mitigation technologies, with a particular focus on industrial SMEs.

Project aggregation and sectoral cooperation

a. Promote project aggregation through regional or sectoral consortia to reach the minimum scale required by European funds or the European Investment Bank.

b. Facilitate platforms for project aggregation and joint technical preparation, encouraging cooperation between companies and technology centers.

c. Support participation in sectoral consortia or networks to share technical, administrative and financial resources, optimizing costs and administrative efforts.

Standardization, certification and replicability tools

a. Develop simplified certification mechanisms to demonstrate project bankability and reduce perceived risk for financial institutions.

b. Create catalogues of standardized projects—bankable templates—by technology and sector, serving as a reference to accelerate replication and reduce structuring costs.

c. Align public calls for proposals with banking products in terms of timelines, guarantees and reporting requirements, facilitating compatibility between public support schemes and private financing.

Financial cooperation and value chain support

a. Establish agreements with financial institutions to adapt credit products and guarantee instruments to the real needs of industrial SMEs, simplifying access to capital.

b. Prepare projects jointly with technical and financial teams, ensuring technological and economic viability from early stages.

c. Develop support programs for SME suppliers to align their projects with the decarbonization objectives of large industrial companies and facilitate their integration into flagship projects.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Promote technical and financial support services for industrial companies preparing green investment projects.

b. Create specific advisory programs for SMEs tailored to sectoral characteristics.

c. Coordinate with the financial sector to align public calls with banking products in terms of timelines, guarantees and reporting requirements.

Autonomous Communities and Local Authorities

a. Implement regional technical advisory programs for SMEs in collaboration with technology centers and innovation bodies.

b. Promote regional or sectoral consortia to enable project aggregation and access to European funds and European Investment Bank financing.

Technology centers

a. Prepare technical and economic feasibility studies for green investment projects.

b. Create and animate platforms for project aggregation and joint technical preparation.

Industrial companies (SMEs)

a. Participate in training and mentoring programs on project management and mitigation technologies.

b. Join sectoral or regional consortia to share technical and administrative resources.

c. Prepare projects jointly with technical and financial teams to ensure technological and economic viability.

Industrial companies (large)

a. Develop support programs for SME suppliers to align projects with decarbonization objectives.

b. Integrate SMEs into flagship projects, sharing resources and technical capabilities.

Financial sector

a. Collaborate in defining clear and harmonized bankability requirements.

b. Adapt credit products, guarantees and maturities to the characteristics of industrial SMEs.

c. Participate in public–private consortia to mobilize funding for green investments.

Possible barriers

a. Complexity and heterogeneity of requirements across different public calls.

b. Limited capacity of SMEs to devote time and resources to project structuring.

c. Reluctance of banks to finance small-scale projects or projects with uncertain returns.

d. Risk of overlap if technical assistance services are not coordinated across public administrations, business associations and technology centers.

5.6 Promote communities of practice and sectoral and territorial collaboration

Description

Territorial collaboration strengthens industrial ecosystem cohesion and accelerates the delivery of projects with local impact. However, in Spain these collaborative frameworks remain fragmented and poorly coordinated. The working group highlighted the need to establish regional communities of practice that bring together industry, energy, finance, public administrations and social partners, adopting an early-stage approach that also addresses social acceptance of green infrastructure. The proposal aims to create stable frameworks for cooperation and joint projects, supported by shared infrastructure and project aggregation mechanisms that enable projects to reach sufficient financial scale.

Objective

To foster territorial and sectoral cooperation in order to accelerate industrial decarbonization. To create collaborative environments that integrate companies, public administrations, finance and civil society.

The ultimate goal is to generate flagship projects with local impact, sufficient scale and broad social acceptance. The objective should also ensure national coordination of regional communities in order to avoid duplication, guarantee coherence and promote territorial equity.

Measures

Creation and strengthening

a. Promote regional communities of practice that bring together actors from industry, energy, finance and public administration, fostering territorial cooperation on decarbonization.

b. Finance regular meetings, innovation labs and joint pilot projects aimed at generating collective learning and accelerating sustainable solution deployment.

c. Enable land and spaces for industrial hubs or clusters with shared energy infrastructure (renewables, heat networks, storage), serving as a foundation for collaborative projects

d. Facilitate the aggregation of SME projects at regional or sectoral level, enabling them to reach the financial and technical scale required to access national or European funding.

Coordination, governance and replicability

a. Establish a national coordination framework linking regional communities of practice with each other and with European initiatives, ensuring coherence, synergies and territorial equity.

b. Equip the national coordination framework with a permanent technical secretariat responsible for consolidating lessons learned, publishing replicable guidance and connecting communities with European innovation and funding programs.

c. Coordinate and support regional communities, ensuring knowledge transfer, result systematization and experience replicability.

d. Provide analytical tools and technical advisory support to territorial consortia to strengthen planning, monitoring and evaluation capacities.

e. Support inclusive governance processes that ensure the stable involvement of social, labor and business stakeholders in decision-making.

Business participation and cross-sector collaboration

a. Actively participate in collaborative spaces, sharing learning, resources and experiences among companies, public administrations and technology centers.

b. Contribute flagship projects that serve as a basis for SME aggregation and the development of new industrial value chains.

c. Participate in communities of practice to identify real industrial needs and to design financial products tailored to projects emerging from these collaborative environments.

Communication and trust

a. Integrate early-stage consultation processes that allow local communities to participate from the initial planning phases and to obtain tangible benefits (employment, services, infrastructure) from new investments.

b. Incorporate communication and public outreach programs to explain the environmental, economic and social benefits of communities of practice, strengthening public trust and the legitimacy of projects.

Stakeholders and implementation context

Central government (MITECO / MINCOTUR):

a. Coordinate a national framework that connects and aligns regional communities of practice.

b. Facilitate access to European and national funding for flagship projects with a strong territorial dimension.

c. Ensure equity across regions and sectors, avoiding disparities in resources and implementation capacity.

Autonomous Communities and Local Authorities

a. Establish regional communities of practice bringing together industry, energy, finance and civil society.

b. Fund regular meetings, innovation labs and joint pilot projects.

c. Allocate land and facilities for industrial clusters with shared energy infrastructure.

d. Support the aggregation of SME projects at regional or sectoral level to reach minimum financing scale.

Technology centers

a. Coordinate and revitalize communities of practice, ensuring knowledge transfer and replicability of results.

b. Provide technical analysis tools and advisory support to territorial consortia.

c. Support inclusive governance processes that integrate social partners, trade unions and business actors.

Industrial companies

a. Engage in communities of practice by sharing experience and participating in joint initiatives.

b. Contribute flagship projects that enable the aggregation of SMEs at territorial level.

c. Promote social acceptance of infrastructure through early consultation and by delivering tangible benefits to local communities.

Financial sector

a. Participate in regional communities of practice to identify industrial financing needs.

b. Design financial products tailored to green industrial and energy projects emerging from these collaborative settings.

Possible barriers

a. Risk of fragmentation if regions develop communities independently without national coordination.

b. Limited early financial commitment from banking institutions.

c. Social resistance if local communities are not informed and involved from the outset.

d. Territorial disparities in the capacity to generate projects or attract financing.

5.7 Streamlining procedures to access public funding

Description

Access to public funding for decarbonization remains one of the main bottlenecks, particularly for industrial SMEs. Although multiple support instruments exist (PERTE, European funds, regional programs), calls for proposals often involve complex requirements, unrealistic timelines and procedures that vary significantly across autonomous communities. The working group stressed that this complexity has a deterrent effect and slows project implementation, even when funding is available. The proposal seeks to reduce bureaucracy, harmonize procedures and accelerate the effective disbursement of funds to companies.

Objective

Reduce the administrative complexity that limits access to financing for industrial decarbonization. Modernize and coordinate procedures so they are more agile, harmonized and aligned with the realities of industrial projects. The aim is to ensure that support reaches companies of all sizes, especially SMEs, in a timely and effective manner. The objective also includes strengthening transparency and fund traceability, so companies can track the status of their applications and budget availability at all times.

Measures

Regulatory and administrative streamlining

a. Review and simplify administrative requirements in calls for industrial decarbonization support.

b. Simplify eligibility checks linked to the EU green taxonomy, removing unnecessary administrative burdens and ensuring proportionality based on project size.

c. Align implementation deadlines for grants and calls with the actual timelines of industrial projects, avoiding the exclusion of viable initiatives due to rigid calendars.

d. Maintain PERTE-type schemes, adapting their conditions and reinstating public guarantees where financial guarantees represent a barrier for SME participation.

Process digitalization and traceability

a. Digitize application, monitoring and justification procedures through a single electronic one-stop shop that centralizes all processing.

b. Introduce digital traceability systems enabling companies to track application status in real time, identify bottlenecks and receive automatic alerts regarding deadlines or required corrections.

Standardization and predictability

a. Establish standardized templates and pre-validation of eligibility to reduce uncertainty and shorten evaluation times.

b. Publish standard application packages by technology or sector, including a single checklist, harmonized technical templates and approved financial annexes.

c. Set up a single, predictable call calendar, reviewed annually, to provide certainty for the industrial sector and facilitate project planning.

Inter-administrative coordination

a. Coordinate national and regional calls to avoid duplication or inconsistencies in selection criteria, deadlines or documentation requirements.

b. Harmonize information and fund management procedures across administrations, promoting the use of interoperable digital platforms.

Technical support and company guidance

a. Act as facilitators throughout the process, providing direct support to companies—especially SMEs—during application and reporting phases.

b. Offer pre-application guidance on requirements, timelines and documentation before formal submission.

b. Establish free or subsidized technical assistance programs for SMEs with limited administrative capacity, ensuring fair and effective access to funding opportunities.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Conduct a comprehensive review of administrative requirements in public funding calls linked to decarbonization.

b. Adjust implementation timelines to reflect the realities of industrial projects.

c. Maintain and adapt PERTE-type schemes, applying simplified criteria and a focus on strategic sectors.

Ministry of Finance

a. Reinstate public guarantees where financial guarantees constitute a barrier to SME participation.

b. Coordinate with autonomous communities in the management of funds and support schemes to ensure procedural consistency.

Ministry of Industry and Tourism

a. Fully digitize application, monitoring and reporting processes for public funding through a single one-stop shop.

b. Introduce standardized templates and pre-validation mechanisms to reduce uncertainty for applicants.

Autonomous Communities and Local Authorities

a. Align regional calls with national ones, avoiding duplication.

b. Adapt requirements to the realities of the local industrial fabric, with particular attention to SMEs.

Specialized intermediaries (consultancies, sectoral associations, technology platforms)

a. Provide guidance and pre-application support services.

b. Offer direct support to SMEs in preparing applications, reducing their administrative burden.

Oversight and transparency bodies (IGAE, AIReF, Court of Auditors)

a. Ensure traceability and transparency in the allocation of funds.

b. Publish regular reports on implementation and outcomes.

c. Recommend improvements to administrative simplification and efficiency.

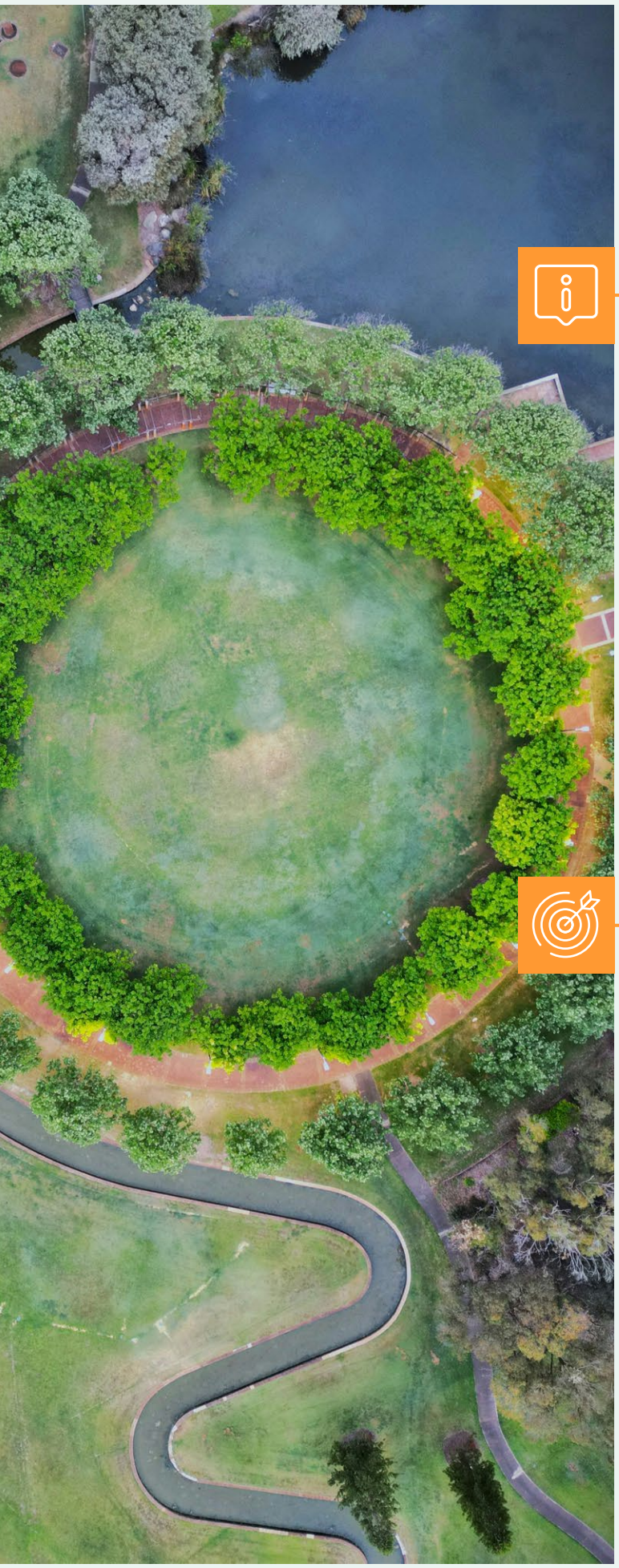
Possible barriers

a. Institutional resistance to changing established procedures.

b. Territorial disparities, with some autonomous communities advancing more quickly than others in digitization and simplification.

c. Limited SME capacity to allocate staff time to administrative procedures, even where these are simplified.

d. Risk of delays if national and regional one-stop shops are not effectively coordinated.



5.8 Strengthening the financing ecosystem for decarbonization

Description

Public and private financing for decarbonization is available, but access remains uneven and complex. PERTE schemes have proven useful, yet they are often characterized by slow procedures and a heavy administrative burden. At the same time, European instruments such as InvestEU, the EIB and the Innovation Fund tend to require project scales that many SMEs cannot achieve on their own. The working group emphasized the need to build a robust financing ecosystem that simplifies procedures, combines European and national instruments, and provides technical support to SMEs and lead companies. The key lies in effective coordination between central government, autonomous communities, public and private banks and sectoral associations, supported by clear, stable frameworks.

Objective

To consolidate a solid and accessible financial support system for industrial decarbonization. This involves coordinating public and private resources within clear and stable frameworks that reduce risk and broaden the reach of investment. Ultimately, the objective is to mobilize capital at scale, with particular emphasis on facilitating SME access to the green transition. Regulatory stability and clear governance structures involving the financial sector are also essential, ensuring transparency in the allocation of funds and predictability for investors and companies.

Measures

Coordination and optimization of public funds

a. Maintain and simplify PERTE schemes, extending their logic to other European funds (ERDF, Innovation Fund) through more realistic technical criteria and reduced administrative burden.

b. Coordinate European and national funding instruments to avoid overlaps, ensure complementarity and maximize investment impact.

c. Establish a single, publicly available funding calendar, updated annually, enabling companies to plan projects more effectively and optimize internal resources

d. Apply the new CISAF framework (2025), which increases aid intensity to up to 45 percent and extends implementation timelines, ensuring adequate budgetary provision.

Transparency and harmonization of criteria

a. Publish sector-specific guidance and provide one-stop information points to harmonize access requirements (carbon footprint, taxonomy alignment, KPIs, additionality), reducing uncertainty and validation times.

b. Align funding requirements with the EU green taxonomy, ensuring regulatory coherence, predictability and confidence for investors and companies.

c. Adopt harmonized metrics—such as cost per ton of CO_2 avoided, share of SME beneficiaries and private capital leverage—and publish results in open formats to strengthen transparency and accountability.

Technical support and SME access to finance

a. Provide technical assistance to SMEs in preparing financially eligible project applications, including the use of Energy Saving Certificates (CAEs) as a complementary instrument.

b. Facilitate project aggregation at regional or sectoral level to achieve economies of scale and meet minimum bankability thresholds required by European funds.

c. Integrate SMEs into flagship projects by sharing guarantees and structuring pre-financing mechanisms that provide liquidity ahead of public fund disbursements.

Financial instruments and co-investment

a. Develop public–private co-investment mechanisms that mobilize private capital through partial state guarantees or European instruments.

b. Strengthen guarantee schemes and blended finance instruments, lowering perceived risk for investors and financial institutions.

c. Promote long-term contracts for renewable electricity and heat to enhance financial stability and reduce exposure to price volatility.

Public banking and support mechanisms

a. Expand ICO credit lines with longer maturities, grace periods and free technical assistance for large-scale operations.

b. Consolidate the role of ICO and CDTI as intermediaries by expanding their thematic scope to energy efficiency, digitalization and innovation, and strengthening their territorial presence, particularly in regions with more limited access to green finance.

Impact evaluation and monitoring

a. Establish impact indicators to assess the effectiveness of mobilized financing in terms of actual decarbonization outcomes, with particular attention to SME participation and green job creation.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Maintain and simplify the PERTE scheme, extending it to other European funds (ERDF, Innovation Fund).

b. Publish harmonized sectoral guidance on carbon footprint, green taxonomy alignment, KPIs and additionality.

c. Coordinate with other ministries to ensure complementary deployment of funding instruments.

Ministry of Finance

a. Apply the CISAF framework (2025), increasing aid intensity and extending implementation timelines.

b. Oversee financial allocation in coordination with the Ministry of Industry and MITECO.

Ministry of Industry and Tourism

a. Integrate sectoral guidance into industrial calls for proposals using harmonized criteria.

b. Collaborate in coordinating European funds applied to industrial decarbonization projects.

Autonomous Communities and Local Authorities

a. Implement territorial coordination of European funds.

b. Adapt business support one-stop shops to nationally agreed common criteria.

Technology centers and sectoral associations

a. Support SMEs in preparing financially eligible project applications, including the use of Energy Saving Certificates (CAEs).

b. Facilitate project aggregation at regional or sectoral level.

Industrial companies (SMEs and large companies)

a. Integrate SMEs into flagship projects through pre-financing mechanisms.

b. Promote long-term contracts for renewable electricity and heat.

Financial sector

a. Strengthen guarantee schemes and develop blended finance instruments.

b. Expand ICO credit lines with longer maturities, grace periods and technical assistance.

c. Consolidate ICO and CDTI intermediation to broaden thematic and territorial coverage.

Governance and oversight bodies (AIReF / Court of Auditors / Bank of Spain)

a. Monitor coordination between European and national funds, avoiding duplication.

b. Assess the efficiency of fund deployment and propose improvements.

c. Ensure transparency and traceability of financing mobilized for decarbonization.

Possible barriers

a. Excessive bureaucracy delaying the execution of public funding.

b. Difficulty for SMEs in reaching the minimum scale required by the EIB or other European instruments.

c. Risk of fragmentation if European and national funds are not properly coordinated.

d. Regulatory uncertainty regarding the application of the green taxonomy and eligibility criteria.

5.9 Establish industrial employment observatories linked to the green transition

Description

The energy transition will significantly affect industrial employment, as some jobs will disappear while new roles linked to low-carbon technologies emerge. Managing this change requires anticipation, reskilling and social support mechanisms that enable workers to adapt to the evolving needs of the green economy. The working group highlighted the need to move beyond stand-alone observatories towards a comprehensive employment and just transition framework that combines labor-market data, active training policies, social conditionality linked to public support schemes, and territorial agreements.

Objective

To anticipate and manage the labor impacts of the energy transition in industry. To integrate monitoring, training and social dialogue mechanisms that support workers and territories throughout the transition. The ultimate goal is to ensure a just transition that protects employment and strengthens social cohesion.

The objective should also enhance the transparency and accessibility of labor-market data, ensuring that it is available in open formats for companies, trade unions, training providers and public administrations.

Measures

Governance and institutional coordination

a. Establish sectoral and territorial observatories to collect up-to-date data on employment in carbon-intensive industries, enabling systematic monitoring of labor-market developments during the green transition

b. Create a Green Industrial Employment Observatory responsible for mapping skills gaps and publishing quarterly open-data reports, integrating national and regional information.

c. Set up a State Commission on Green Employment and Skills, with participation from autonomous communities, employers' organizations, trade unions and technology centers, to coordinate employment policies linked to decarbonization.

d. Maintain the PERTE framework, incorporating employment and skills clauses into public procurement and flagship projects to link investment with green job creation.

e. Promote sectoral transition agreements (steel, cement, chemicals, etc.), following the model applied in coal mining and thermal power plants, as references for future industrial restructuring processes.

Training, reskilling and skills adaptation

a. Design reskilling and anticipatory training plans for workers at risk of job displacement due to technological or energy transitions.

b. Adapt training provision to the skills required by low-carbon industries, in collaboration with companies, technology centers and training institutions.

c. Support training and reskilling programs promoted by public administrations or sectoral observatories to ensure continuous workforce upskilling.

d. Establish employment and skills plans linked to corporate decarbonization strategies, ensuring the necessary skills development for the technological transition.

Labor impact analysis, monitoring and evaluation

a. Define strategic labor indicators to measure job creation and job transformation, as well as the quality and long-term sustainability of the jobs generated.

b. Integrate labor impact assessments into corporate decarbonization plans, identifying green job opportunities and risks of sectoral displacement.

c. Publish regular reports on the employment impacts of the green transition, with sectoral and territorial breakdowns, to inform active labor-market and reskilling policies.

Redeployment and just transition mechanisms

a. Develop an inter-territorial green employment pool linked to employment observatories to facilitate the redeployment of workers displaced by the energy transition.

b. Establish employment and training commitments at plant and territorial level through joint skills committees, ensuring participatory and equitable management of labor transitions.

Stakeholders and implementation context

Ministry of Labor and Social Economy

a. Establish sectoral and territorial employment observatories in carbon-intensive industries.

b. Set up the State Commission on Green Employment and Skills with broad stakeholder representation.

c. Design reskilling and anticipatory training plans for workers at risk.

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Integrate labor criteria into industrial decarbonization strategies.

b. Maintain the PERTE framework, incorporating social and skills-related conditionality.

Autonomous Communities and Local Authorities

a. Participate in the State Commission on Green Employment and Skills.

b. Promote regional observatories on green industrial employment.

Trade unions and employers' organizations

a. Define strategic labor indicators and promote just transition agreements.

b. Negotiate employment and training commitments at plant or territorial level.

c. Integrate labor impact analysis into decarbonization strategies.

Training and education providers

a. Adapt curricula and training programs to low-carbon skills requirements.

b. Contribute to the Green Industrial Employment Observatory by mapping skills gaps.

Industrial companies

a. Integrate labor impact analysis into decarbonization strategies.

b. Establish employment and skills plans linked to industrial decarbonization.

c. Participate in inter-territorial green industrial employment pools.

Data and transparency bodies (INE, SEPE, regional observatories)

a. Ensure the quality and consistency of labor-market data related to the green transition.

b. Publish observatory outputs in open and accessible formats.

c. Coordinate with trade unions, employers and training providers to update employment and skills projections.

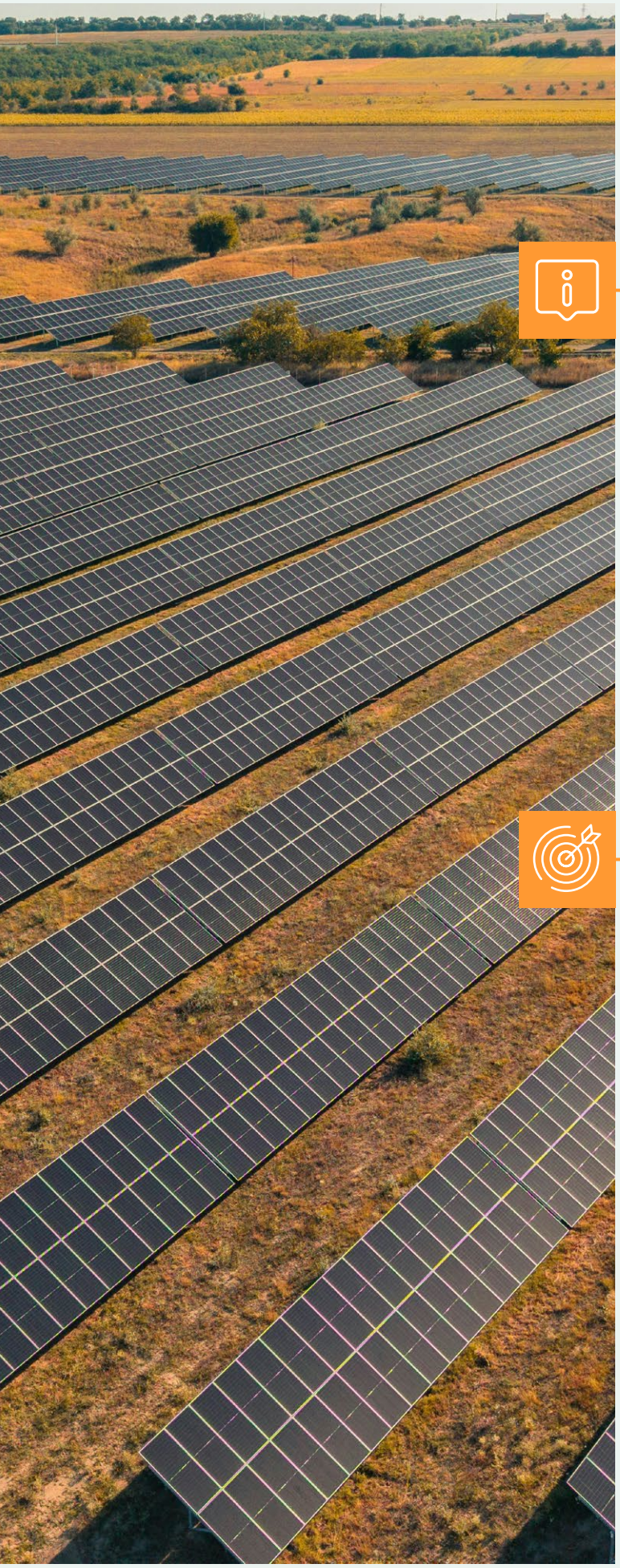
Possible barriers

a. Difficulty in coordinating across administrations, companies and trade unions.

b. Territorial disparities in access to reskilling and retraining programs.

c. Resistance from some companies to linking public support schemes to employment commitments.

d. Shortages of trained technical profiles given the pace of the transition.



5.10 Strengthening education and training for industrial decarbonization

Description

Developing the technical and management skills linked to the green transition is a prerequisite for industry to deploy low-carbon technologies. Currently, there is a significant shortage of specialized profiles in electrification, hydrogen, biomethane, energy efficiency and climate finance. Formal education has yet to mainstream these contents, while SMEs often lack the resources to upskill their workforce. The **proposal seeks to promote a comprehensive and flexible education and training offer**, combining formal curricula, dual training programs and fast-track micro-credentials, in partnership with universities, vocational education and training (VET) providers, technology centers and companies.

Objective

Develop the technical and management skills required for industrial decarbonization. Align formal education and lifelong learning with the real needs of the productive base and upgrade skills across all levels. Ultimately, the aim is to build a workforce capable of accelerating the deployment of low-carbon technologies and strengthening competitiveness. These initiatives should be coordinated with European green skills initiatives (Pact for Skills, Net-Zero Industry Academies) to ensure mutual recognition and labor mobility, while also providing long-term regulatory certainty.

Measures

Curriculum modernization and training content

a. Establish vocational training and university curricula that include compulsory modules on energy efficiency, electrification, hydrogen, biomethane, measurement and verification (M&V) and climate finance.

b. Align training plans with the skills projections developed by green industrial employment observatories and sectoral clusters, ensuring consistency between educational provision and actual demand in the industrial base.

c. Integrate modules on just transition, trade union participation and social dialogue into training programs, so that new skills are developed in parallel with job protection and social cohesion.

Continuing training and skills accreditation

a. Establish fast-track, accredited micro-credentials for operators, technicians and middle managers, enabling rapid upskilling in green technologies

b. Advance a European system for modular micro-credential accreditation, with cross-border recognition and automatic mutual recognition across EU Member States.

c. Ensure that the acquisition of green skills is recognized in pay structures and career progression, including incentives in collective agreements and internal promotion frameworks.

d. Promote internal reskilling through training-time arrangements that allow work and professional development to be combined.

Training infrastructure and public–private collaboration

a. Establish sectoral academies with training pathways tailored to the processes of key industrial sectors (cement, chemicals, paper, food, metallurgy), in collaboration with universities, technology centers and companies.

b. Promote dual training programs in partnership with industrial companies, integrating hands-on experience into curricula and supporting early labor market entry.

Training infrastructure and public–private collaboration

a. Establish sectoral academies with training pathways tailored to the processes of key industrial sectors (cement, chemicals, paper, food, metallurgy), in collaboration with universities, technology centers and companies.

b. Promote dual training programs in partnership with industrial companies, integrating hands-on experience into curricula and supporting early labor market entry.

Stakeholders and implementation context

Ministry of Education and Vocational Training / Ministry of Universities

a. Introduction of compulsory modules in vocational education and training (VET) and university programs on green technologies and climate finance.

b. Development and accreditation of fast-track micro-credentials for technical and operational profiles.

Ministry of Finance

a. Establishment of tax incentives and specific support schemes for SME investment in training.

Autonomous Communities and Local Authorities

a. Adaptation of regional education and training provision to new curricula and micro-credentials.

b. Collaboration with VET centers and universities in dual training programs.

Technology centers and universities

a. Creation of sectoral academies with dedicated learning pathways for strategic industrial sectors.

b. Promotion of dual training programs in coordination with companies.

Industrial companies

a. Promotion of internal reskilling through training-time agreements.

b. Salary and professional recognition of the acquisition of green skills.

Trade unions and labor organizations

a. Participation in the design of reskilling pathways to ensure employment protection.

b. Promotion of collective agreements that recognize the acquisition of green skills.

c. Support for just transition programs in collaboration with companies and public administrations.

Possible barriers

a. Long lead times for adapting formal curricula.
b. Shortage of trainers specialized in green technologies.
c. Reluctance among SMEs to invest in training where returns are not immediately visible.
d. Difficulties in harmonizing micro-credentials at national and European level.

5.11 Improving social acceptance of green projects

Description

Industrial decarbonization requires new infrastructure, including renewable energy installations, electricity grids, storage, hydrogen and biomethane facilities. These projects often face social opposition due to their perceived impact on local environments. The working group emphasized that social acceptance cannot be addressed solely at the permitting stage but must be built from the earliest phases of planning through transparency and the creation of shared benefits for communities. The proposal seeks to build social license through citizen participation, transparent communication and concrete mechanisms for territorial benefit-sharing.

Objective

Promote early participation, transparency and territorial benefit mechanisms, supported by a sustained presence in the territory. The overarching aim is to secure a durable social license in order to accelerate sustainable industrial and energy investments. This requires embedding just transition commitments and delivering tangible benefits for local communities, ensuring territorial equity and avoiding the concentration of impacts in vulnerable areas.

Measures

Participation and inclusive governance

a. Promote early participation processes in industrial and energy projects, involving local communities from the initial planning stage.

b. Facilitate structured dialogue spaces between companies, civil society and public authorities—particularly local councils—to build consensus and prevent conflict.

c. Include mandatory community participation clauses in large strategic projects, ensuring formal representation in governance bodies.

d. Integrate social acceptance considerations into territorial planning for industrial and energy projects, addressing social and environmental impacts from the outset.

e. Promote independent mediation processes to resolve territorial conflicts and strengthen trust in decision-making.

Communication, awareness and public engagement

a. Implement national communication campaigns showcasing real cases of environmental, economic and competitiveness gains, reinforcing positive perceptions of the green transition.

b. Embed awareness-raising and public engagement from the early stages through structured dialogue and transparent communication roadmaps, clearly defining expected social and territorial benefits.

c. Proactively communicate the positive impacts of investments in terms of employment, sustainability and local well-being.

Territorial benefits and shared value

a. Establish community funds, local tariffs or employment programs linked to projects, ensuring that investment benefits translate into tangible improvements for host communities.

b. Link benefit-sharing mechanisms—such as funds, employment or tariffs—to verifiable performance indicators and annual social audits, ensuring accountability and transparency.

c. Maintain dedicated professionals with a continuous local presence to manage community relations and ensure compliance with social commitments.

Transparency, monitoring and accountability

a. Ensure transparency in public consultation processes and project monitoring, guaranteeing open access to information and full traceability of decisions.

b. Create citizen observatories to monitor social and environmental commitments, publishing information in formats that are accessible and understandable to the public.

Stakeholders and implementation context

Ministry for Ecological Transition and Demographic Challenge (MITECO)

a. Establish early participation frameworks for industrial and energy projects, ensuring consultation at the earliest planning stages.

b. Oversee transparency in public consultation processes and project monitoring.

c. Integrate social acceptance considerations into the strategic planning of energy infrastructure.

Ministry of Industry and Tourism

a. Coordinate communication campaigns that highlight the environmental and competitiveness benefits of industrial investments.

b. Incorporate social acceptance criteria into the definition of strategic industrial projects, in coordination with MITECO.

c. Promote successful case studies as reference examples to strengthen public trust.

Local governments

a. Organize structured dialogue spaces between companies, public authorities and civil society to build consensus.

b. Integrate social license criteria into urban and territorial planning.

c. Implement mechanisms for direct territorial returns, such as local employment programs, community infrastructure and other tangible benefits.

Industrial companies

a. Establish mechanisms for economic and social returns to host territories, including community funds, local tariffs or training and employment programs.

b. Maintain specialized community relations teams with a permanent presence in affected territories.

c. Communicate proactively and in a structured manner about positive impacts in terms of employment, sustainability and competitiveness.

Civil society and trade unions

a. Participate in project governance structures.

b. Promote territorial agreements that ensure shared benefits and help prevent social conflict.

c. Collaborate in citizen observatories to ensure transparency and legitimacy.

Possible barriers

a. Public mistrust of large industrial or energy projects.

b. Risk of perceived greenwashing if communication campaigns are not backed by tangible benefits.

c. Territorial conflicts arising from unequal distribution of impacts and benefits.

d. Limited local capacity to engage effectively in technical consultation processes.

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Appendix. Members of the alinnea working group

Name	Surname	Company	Position
Agustín	**Martín**	AAPP Mobility	Chief Executive Officer & Manager
Alberto	**Serafín Jiménez**	Caixabank	Advisor
Alberto	**Toril**	Cleantech for Iberia	Director of Sustainability
Álvaro	**Martin Centeno**	Amara Nzero	Director of Sustainable Business Product Coordination
Álvaro	**Colino**	CaixaBank	Director of Industry and Energy
Álvaro	**Ballarin Cabrera**	CEOE	Sustainability and Climate Change Analyst
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Spanish industry is currently at the centre of a transformation process towards a competitive, low-carbon economy. This report provides an analysis of the current state of the industrial sector, identifies the bottlenecks hindering the transition, and puts forward concrete proposals to address them.

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