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New industrial policies: lessons for the EU and the Clean Industrial Deal

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The global industrial policy landscape has fundamentally shifted in recent years, driven by heightened climate ambition following the Paris Climate Agreement, supply chain vulnerabilities, and increased geopolitical tensions. In this context, elevated decarbonization and economic security have emerged as core objectives of industrial policy, prompting major reconfigurations of policy tools worldwide. Based on a systematic review of industrial policy approaches in 10 countries (China, France, Germany, Italy, Japan, Poland, South Korea, Spain, Sweden, United States) and the EU as a region, this *Study* examines recent industrial policy efforts more specifically in Japan, South Korea, China, the EU, and the US, revealing several critical trends.

This new generation of industrial policies marks a definitive shift towards mission-oriented policy approaches focused on societal goals such as the green transition, as illustrated by the increasing use of techno-economic roadmaps across multiple countries. While R&D remains foundational, economic incentives are increasingly prioritizing the deployment and scale-up of new technologies, including clean technologies. Transition instruments are being developed beyond carbon pricing to encompass regulations and economic incentives that include technological, environmental or localized criteria to boost domestic manufacturing output. Finally, several countries are developing proactive but limited policies to address the inevitable redistributive impacts of moving away from older, carbon-intensive economies. These policies are known as 'just transition' measures.

This is happening in an environment of intense global competition to localize clean technology production and secure critical materials. To ensure the success of the Clean Industrial Deal, this report recommends that the EU take action across different areas.

KEY MESSAGES

The European Union should:

- **Maintain clarity on decarbonization and develop an ambitious circular economy agenda:** Uphold the long-term decarbonization course to anchor investment expectations and integrate material efficiency and circularity directly into the industrial strategy to differentiate the EU in the global economy, strengthen supply security, drive decarbonization, and create new economic activities.
- **Enhance EU-level coordination on industrial policy** through the creation of sectoral and technological roadmaps to prioritize essential clean value chains.
- **Complete the policy mix to secure investments in Europe:** Mobilize substantial additional funding for industrial transformation to cover the investment shortfall, while also accelerating electrification and utilizing lead markets and targeted EU preferences to stimulate demand for green products.
- **Implement proactive just transition policies** by increasing the scale and scope of just transition initiatives to anticipate transformation, identify opportunities based on comparative advantages, and address the redistributive impacts of structural change in old industrial regions.

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EXECUTIVE SUMMARY

Since 2019, many countries worldwide have updated their industrial policies. This has occurred in a context marked by heightened climate ambition following the Paris Climate Agreement, the COVID-19 pandemic and its consequences, and the reinforcement of geopolitical tensions, notably after the war in Ukraine. As a result, decarbonization and economic security are increasingly cited among the objectives of economic policies, leading to the creation of, or changes to, existing policy tools that promote industrial development.

In Europe, this new landscape has sparked a major debate on how to balance competitiveness with decarbonization and enhance economic security. This conversation culminated in two key reports: the Letta report[1] on the future of the European Single Market and the Draghi report[2] on European Competitiveness. Both reports advocate for a new direction in European policy, emphasizing the need for a more active and coordinated industrial policy and a revision of Single Market rules to tackle these three challenges. These two reports led to the creation of a new agenda for the European Union heavily focused on the EU's economic competitiveness and to the launch of the Clean Industrial Deal,[3] whose main objective is to make decarbonization a key engine of European economic growth, and through several policy initiatives designed to achieve this.

The widespread adoption of new industrial policies with decarbonization as a core objective warrants close examination. It is important to better understand their true potential for achieving sustainability and transforming the world economy, in line with the core ambition of the Paris Agreement,[4] as well as to identify promising practices and key differences across geographies. Divergent approaches also carry risks. They can lead to new tensions and fragmentation between different regions and economic blocs. Understanding these dynamics is crucial for navigating the evolving global economic landscape. This *Study* contributes to this effort, by examining the recent resurgence of industrial policies in East Asia, the EU, and the US—their key features and differences. It aims to inform the current European debate on the Clean Industrial Deal.

The main findings of this *Study* are as follows.

Ten years after the Paris Agreement, decarbonization is one of the main justifications for new industrial policies, alongside security and competitiveness. This new focus has spurred significant initiatives to reorient existing policies and design new ones, providing a clear signal that climate policy is now at the core of economic policymaking. In several countries, and until recently in the US, greening industry while increasing security and competitiveness is an emerging paradigm.

Policy directionality is increasingly recognized as a crucial factor for the success of industrial policies. A new generation of «mission-oriented» policies is being developed and implemented globally. These policies set specific societal goals—like the transition to a green economy—and then align a wide range of public and private efforts to achieve them. As a consequence, we can see the emergence of new techno-economic planning for the decarbonization of the economy that eventually leads to clear technological choices/roadmaps (Japan, France, Sweden).

[1] https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

[2] https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en#paragraph_47059

[3] https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en

[4] Torres Gunfaus, M. *et al.* (2025). Paris+10 diagnosis: Looking back to look forward. IDDRI, Working Paper N°01/25. https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Document%20de%20travail/202506-WP0125-Paris%20Agreement%20Diagnosis_0.pdf

These can be totally new or build on existing planning exercises and aim at informing a comprehensive policy mix in order to meet policy objectives. This has sparked important debates about how specific or broad public policy choices should be when setting priorities, illustrated by the ongoing debate on technology neutrality and, more broadly, on the governance framework to ensure that policies are not overly influenced by special interests through regulatory capture.

To date, industrial policy in East Asia, Europe and the US remains essentially driven by innovation policy while support for deployment and scale up is on the rise. Research & Development support continues to be the backbone of industrial policy, but there is a significant increase in funds dedicated to the deployment and scale-up of new technologies and activities. All studied countries have some form of support for innovation, mostly through tax credits that were increased in recent years in a number of countries. Direct R&D support and innovation tax credits increasingly target strategic sectors and priorities, among which clean technology manufacturing and deployment. In several countries, innovation policies are expanding to deployment of new technologies on top of R&D support.

Transition policy instruments are being reassessed globally, with a strong focus on increasing domestic manufacturing output. Carbon pricing policies are on the rise, especially in Asia, with carbon border adjustment mechanisms to address the risk of carbon leakage being developed alongside. They are nevertheless not seen as sufficient in themselves to develop a clean industry and are often accompanied by complementary policies targeting specific industries or value chains and securing their location. On top of subsidies for clean manufacturing, new support schemes based on carbon pricing guarantees are being tested in Europe to decarbonize heavy-industry plants. Demand-side policies are expanding to new sectors such as industrial decarbonization, hydrogen or the electrification of transport with either technological, environmental, or location-wise criteria attempting to support domestic manufacturing.

Recent industrial policy initiatives targeting "just transition" have been developed within the EU and the US. The shifts in activity linked to the transition lead to redistributing comparative advantage across regions and declining economic activity and employment in specific sectors and areas, especially those linked to fossil fuel industries in countries with a long history of industrialization. Initiatives to deal with these adjustments are underdeveloped globally but several have been adopted in recent years. In the US, bonus tax credits were offered for investments in deprived areas in the context of the Inflation Reduction Act (IRA). In Europe, the Just Transition Fund aimed to support economic reconversion of coal-dependent regions. In Spain, the just transition policy developed place-based incentives to accompany affected regions. This also happens while there is a realization in Western countries that the "China Shock» had far-reaching political and socioeconomic effects, and has therefore brought more attention to creating «good industrial jobs».

Countries have entered an intense competition globally to capture new markets, localize production and mitigate supply chain risks especially in critical materials. Clean tech sectors are particularly affected, as they are increasingly considered strategic. This is illustrated by the adoption of more aggressive tools designed to secure domestic production and reduce dependencies, particularly on China, and the fact that de-risking and competition for resources are dominant priorities of recent international initiatives linked to industrial policies. There is a risk that such a strategy be counterproductive and deepen the imbalances already at play in the world economy if not complemented by targeted cooperation to mitigate risks brought by the evolution of industrial activities.

Despite the important long-term direction to decarbonize provided by the Green Deal and the recent development of industrial policies across the EU and its Member States, the EU is lagging in greening its industry. This setback is primarily attributable to the fallout from the energy crisis and intense international competition that has partly offset the early technological developments. Consequently, recent emission reductions appear more linked to the decrease in economic activity than to genuine structural change. This stagnation is evidenced by key indicators, such as electricity consumption hovering at 25% (far below the 2030 target of 41%) and the circular material rate remaining at 11.8% (less than half the 23.4% 2030 target).[5]

Against this backdrop, and drawing from the current assessment of industrial policies, across countries, this report recommends that several priorities be placed at the core of the ongoing European industrial agenda following the establishment of the Clean Industrial Deal.

Stay the course of decarbonization. It aligns with scientific consensus and can provide European economic actors with a clear direction to anchor long-term expectations and consistency guiding industrial investment choices. This can be combined with EU strategic autonomy objectives through the prioritization of sectors, value chains and technologies considered to be essential for a clean EU economy. It also constitutes a key strategic advantage in an increasingly challenging situation in other countries. This clarity is all the more necessary given that investments to decarbonize are significant. The current uncertainty surrounding the 2040 objective needs to be quickly resolved, as it has important knock-on effects on the reform of the Emissions Trading System (ETS) and the broader post-2040 energy-climate framework that industries are already anticipating.

[5] See European Climate Neutrality Observatory Progress tracker: https://climateobservatory.eu/progress-tracker

Develop a more ambitious circular economy agenda. The EU can establish a unique position by prioritizing the circular economy and material efficiency, a domain overlooked in other major economies' industrial strategies to date and with significant potential to combine strategic autonomy and decarbonization and redefine economic partnerships. By integrating circularity directly into the industrial strategy, rather than treating it as a separate policy, the EU can significantly strengthen its supply security, make a greater contribution to decarbonization, and create new jobs.

Complete the policy mix to secure investments in Europe. To secure the necessary investments in Europe, the policy mix must ensure transition investments happen at a faster pace. As it stands, the EU budget proposal for 2028-2034 is insufficient. The Competitiveness Fund only proposes an additional €26.2 billion over 7 years for the clean transition pillar on top of the Innovation Fund, to compare with an estimated decarbonization investment need of €406–€462 billion per year. This shortfall should prompt a discussion on how to mobilize additional funds to finance the industrial transition. Without the fiscal firepower of the US federal government, the Draghi report proposes to increase EU funding for common industrial priorities from the issuance of common debt. Another major focus should be to accelerate electrification and strengthen energy infrastructure deployment while developing lead markets to stimulate demand for green products. This can often be more effective in securing investment than subsidies. It fosters competition between innovative and incumbent players and leverages the power of the currently fragmented Single Market to create demand for new climate-friendly products and services. As such, it can spur innovation and favour EU-made goods while mitigating the risks of an open economy.

Anticipate structural changes and redistributive impacts of industrial transformations and address them through proactive place-based industrial policies. Most EU countries are old industrial economies, which need to address the redistributive impacts of structural changes. In the face of this challenge, the EU's current Just Transition Fund is far too modest, totaling only €17.5 billion over 7 years and limited primarily to regions transitioning away from coal. Furthermore, certain EU financing instruments lack criteria directing support towards territories at risk of decline. The EU should consider implementing practices that have proven successful elsewhere, such as Spain's use of bonuses for projects in declining zones and targeted calls for tender. The current Commission's effort to develop comprehensive roadmaps for employment and skills and establish a robust just transition observatory along with an assessment aiming at identifying the competitive advantages of European regions should serve as a basis to evaluate the needs and opportunities linked to the European industrial transformation.

Improve the governance of key industrial value chains. Industrial policy necessitates a more active role for public authorities, particularly at the European level, and dedicated governance institutions. For its industrial policy agenda, to succeed the EU should break down silos and enhance EU-level coordination. To do so, the EU could use or create sectoral and technological roadmaps to prioritize specific technologies and tailor policies to achieve production thresholds or societal objectives. This is very much what Japan and South Korea have done for years, and what several EU Member States (Sweden, France) have started doing to implement industrial decarbonization. Sectoral dialogues organized in the context of the Clean Industrial Deal, which produce valuable, consensus-based measures, could also serve as a basis to strengthen governance and follow-up on recommendations.

Adopt a targeted approach to EU preference, and trade and investment partnerships. The geographical dimension of industrial activities is becoming preeminent as illustrated by the debate on European preference and the establishment of new trade and investment partnerships to support the clean transition. Following practices elsewhere, such as the US «Buy America, Build America» Act and the Clean Vehicle Tax Credit, the EU is increasingly integrating EU preference in its policy mix and considering local content requirements into its policies. The Net-Zero Industry Act already allows for incentives favouring European products under specific conditions. These EU preference mechanisms can be compatible with redefining economic partnerships around the industrial transition, provided the EU develops a shared view across its Member States of its specialization and adopts a targeted approach in deploying these EU preferences in strategic activities and technologies.

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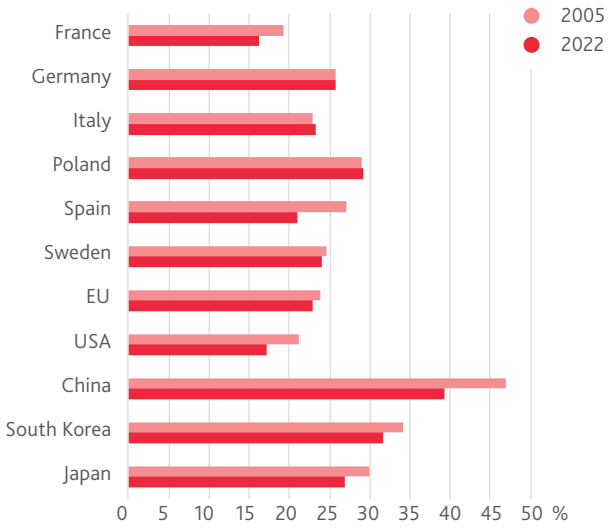
INTRODUCTION

Our comparative study of industrial policies relies on a systematic review of industrial policy approaches in 10 countries and the EU, with a focus on their industrial strategies, support mechanisms for green industry and industrial decarbonization (both from the supply and demand sides), the international dimension and how circular economy and just transition issues are embedded in these frameworks. Through this systematic review, we have observed that industrial policies may differ significantly across different features:

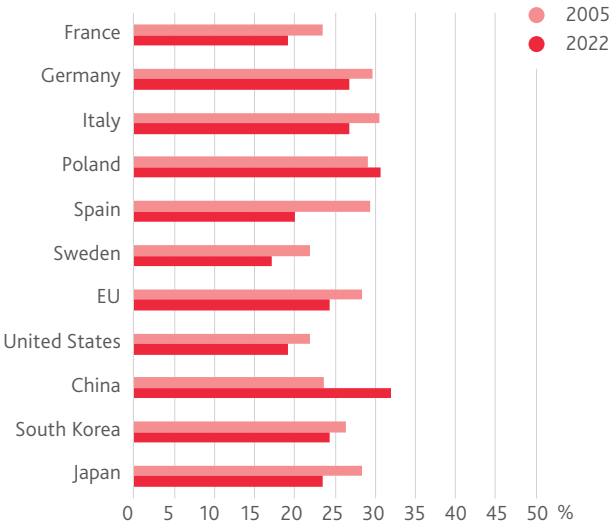
- Their main objectives and the degree to which governments implement them by setting targets and governance frameworks.
- The "historical" mechanisms used for competitiveness and environmental policies, such as R&D support mechanisms, carbon pricing and subsidies for private demand for clean technologies.
- The "new" industrial policies relying on new support to manufacturing (especially for clean technologies but not only), the decarbonization of heavy industry and the use of more controversial features supporting demand in "strategic" sectors such as public procurement or local content requirements.
- The topic of just transition in a context of industrial, territorial and employment transition and whether it leads to specific policy initiatives.
- Finally, the existence or not of dedicated initiatives to deal with the international dimension of industrial policy and, when they exist, the motivation and focus of different countries regarding these initiatives.

Figure 1. Industry as % of GDP



Source : World Bank Data

Figure 2. Industry jobs as share of total employment



Source : World Bank Data

1. DIRECTIONALITY AND POLITICAL GUIDANCE

KEY TAKEAWAYS

A new generation of mission-oriented industrial policies is being developed in different contexts across the different countries we covered. They generally pursue similar objectives with variations in the weight given to them: improving competitiveness of national manufacturing capacities, with a focus on "strategic technologies", securing global value chains especially for "critical" components, maintaining or increasing industrial employment and decarbonizing industrial production.

These strategies are embedded in specific national political and economic contexts, which largely drive how strategies are defined and policy tools applied. While Asian countries have strongly rooted public institutions with strong interfaces with key industrial stakeholders, and a long-lasting culture of economic interventionism enabling the definition of detailed technological planning, the US has attempted a deep repositioning of its economic policy towards more hands-on industrial policy but with a less planned strategy and greater political variability. The EU, with limited legal competence for industrial policy but with important competences on trade, competition and market regulations, has steadily committed to a more active role through regulatory action aligned with the Green Deal and more specifically the decarbonization and strategic autonomy agenda.

Member states have supported this European shift towards a more interventionist industrial policy. This movement was accelerated by i) the NextGenerationEU plan, providing more fiscal space especially for budgetary constrained Member states, and; ii) the economic and political risks posed by the large-scale Russian invasion of Ukraine. National strategies are broadly targeting the same main objectives (digitization and improvement of competitiveness, greening of manufacturing, reindustrialization) and sectors (mostly clean technologies, biotechnologies, and the digital sector). They however differ in how they were framed at the national level (Germany with an industrial strategy, France with a patchwork of policy initiatives and documents or Spain in its reconstruction and resilience plan), as well as in the related institutions and tools.

1.1. More active industrial strategies

Industrial policies have recently experienced two profound and related evolutions. The first is a theoretical and academic, involving a shift in the perception of industrial policies in the academic and institutional literature. Our study is not intended to provide a review of this recent scientific literature on industrial policies but we can broadly trace a change from a traditionally negatively perceived to a more "optimistic" stance towards industrial policy since the seminal paper of Cherif & Hasanov (2019)[6] on the so-called "policy that shall not be named". This body of literature also highlights the role of mission-oriented policies.[7] It is now part of a now well-known "textbook" for industrial policy, and highlights the importance of defining clear strategies matching well-defined objectives to a set of coordinated policies.[8] In short, academic literature is moving from the question of whether to engage in industrial policy to addressing how it should be designed.

The second and perhaps more important evolution is the development in parallel of new industrial strategies in all major economies: Northeast Asia, the US and the EU. In reality, the international comparison of industrial strategies shows clear differences across regions. These national differences are largely the result of country-specific political and economic history, with clearly diverging positions of the State with respect to private initiative, political guidance over the economic sector and the role of industrial policy in economic growth.

Japan and the Republic of Korea have a long history of strongly directed industrial policies, which were key to the Northeast Asian economic "miracle". This history has led to the development of government bodies, such as the Japanese Ministry of Economy, Trade and Industry (METI), strongly embedded with powerful and organized industrial sectors (notably the steel industry in the case of Japan). In Korea, industrial policy was also a key policy for Korean emergence during the Park Chung-hee era that drove the rise of the heavy-chemical

[6] Reda Cherif & Fuad Hasanov (2019). "The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy," IMF Working Papers 2019/074, International Monetary Fund.

[7] In an important paper about industrial policy frameworks, Criscuolo, C *et al.* (2022) refer to Larrue (2021) for defining a mission-oriented innovation policy as a "coordinated package well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines", extending that definition naturally to industrial policy. Criscuolo, C. *et al.* (2022). "An industrial policy framework for OECD countries: Old debates, new perspectives", *OECD Science, Technology and Industry Policy Papers*, No. 127.

[8] For references see: Rodrik, Dani (Sept. 2014). "Green industrial policy", *Oxford Review of Economic Policy* 30 (3), pp 469–491; Mazzucato, Mariana (Oct. 2018). "Mission-oriented innovation policies: Challenges and opportunities", *Industrial and Corporate Change* 27 (5), pp 803–815; Criscuolo, Chiara and Guy Lalanne (Dec. 2024). "A New Approach for Better Industrial Strategies" *Journal of Industry, Competition and Trade* 24 (1).

industries in the Republic of Korea (RoK).[9] The economic importance of the Chaebols, familial conglomerates with ties in many different economic sectors, has led to a strong collusion of these companies with political actors and mutual influence over the industrial (and economic) development of Korea.

These strong ties between the industrial and political spheres have persisted and the same bodies that oriented industrial policies during the 70s and 80s are still central in the definition of the new wave of industrial policies. In Japan, the METI released its landmark *GX (Green transformation) strategy* in 2023 while the RoK defined its *First Basic Plan on Promoting National Strategic Technology* by the end of 2022. The Japanese strategy was built in successive steps with a first formulation of a *Green Growth Strategy* by the METI in December 2020, updated in June 2021 and leading to the publication of "*Basic Policy for GX*" in February 2023. This Basic Policy was further detailed by the end of 2023 into detailed sectoral decarbonization roadmaps[10] selecting precise technological investments supported by the GX policy. In the case of the RoK, the government has consistently defined 12 "national strategic technologies"[11] since the publication of the "*National Strategic Technology Nurture Plan*" in October 2022.

In China, the State plays a central role in guiding industrial (and more generally economic) development, through its process of general economic planning. Nonetheless, Chinese five-year plans (the 14th FYP, further detailed in sectoral FYPs such as the *Five-Year Green Development Plan for the Industrial sector*) reflect a different approach to industrial strategy. China has multiple layers of strategic documents (at the national, provincial or sectoral levels) that define high-level techno-economic targets (reducing carbon emissions by 18% by 2025 and lowering energy intensity by 13.5% per unit of value-added industrial output) and broad targeting of key sectors according to political priorities. For instance, the latest FYP has defined the concept of "green development" which is a "new development concept" that combines "sustained and healthy economic development" with "obvious improvements in quality and efficiency". Overall, since the definition of the "Made in China 2025" strategy, there has been a constant effort by the Chinese government to drive industry up in the value chain and manufacture complex high-technology products. National FYPs defined by the National Development and Reform Commission (NDRC) are then detailed at the province level, with significant latitude for provincial governors on ways to achieve national objectives. This eventually leads to limited consistency of the actual policy implementation with respect to the announced objectives.[12] Nonetheless, our interviews highlighted the political importance of targets in these strategies to drive policy and economic transformations. Targets tend to be defined conservatively, as failure to achieve these objectives is perceived as carrying a strong reputational and political cost (most notably for province governors) and hence local actors tend to take these seriously and abide by them. Further evidence of the importance of these targets is provided by instances when they become difficult to reach, one such example being the deployment of electric arc furnaces in the Chinese steel industry. In 2022, the Ministry of Industry and Information Technology (MIIT) reduced the target of crude steel production using EAF capacity from 20% in the FYP to 15% by 2025 (in 2022, 9.5% of crude steel was produced with EAF).[13]

In the aftermath of the Covid-19 crisis, the US engaged in a more active industrial policy (complementing a more defensive trade policy) to solve the perception that the country was impacted by unbalanced globalization. The Biden administration made it an important priority and the "Build Back Better" bill aimed to provide a political response. Eventually, the bill was defeated in the Senate in December 2021. However, the Biden administration managed to build a political consensus around the Inflation Reduction Act in August 2022, which was immediately perceived (especially by "allied" countries) as a major change in the US definition of globalization. The Biden administration formulated an *ex post* narrative of a so-called "industrial policy for the middle-class". This was structured around the speeches by former National Economic Council (NEC) Director Brian Deese on 13 October, 2022, complemented by a speech by Jake Sullivan in April 2023, former National Security Advisor, highlighting the international dimension of this strategy. These two speeches summarize the main challenges and arguments supporting this new focus on industrial policy: global value chains are not sufficiently resilient and are subject to economic coercion from rival countries (especially China), the relocation of industrial production in foreign countries has important local social costs that increase inequalities and weaken democratic institutions, and the green transition brings new investment needs (in infrastructure and equipment) that require State involvement in imperfect markets. The importance of these arguments made *ex post* must however not be overstated. The corpus of bills that constitutes the recent American industrial policy (the Bipartisan Infrastructure Law, the CHIPS and Science Act and the Inflation Reduction Act) was not planned (and to a certain extent not anticipated) *ex ante* in a strategic document.

[9] There is a rising academic literature revisiting the effect of industrial policies in Northeast Asia with the example of HCI policy in Korea notably studied in Lane, Nathaniel (2024). "Manufacturing Revolutions: Industrial Policy and Industrialization in South Korea", *CESifo Working Paper* No. 11388.

[10] "Sector-specific Investment Strategies" (in Japanese) defined by the METI on 22 December, 2023 for 22 sectors and revised (in Japanese) for 16 sectors on 27 December, 2024.

[11] Semiconductor and display, secondary cells, leading-edge mobility, next generation nuclear energy, leading edge bio, aerospace and marine, hydrogen, cybersecurity, AI, next generation communications, leading edge robotics and manufacture, and quantum.

[12] García-Herrero & Krystyanczuk show in a recent paper that the actual selection process of private companies receiving public support under the 10,000 Little Giants strategy does not necessarily comply (or even systematically miss) with the announced criteria defined in public strategy papers. García-Herrero, Alicia and Michal Krystyanczuk (Apr. 2024). "How Does China Conduct Industrial Policy: Analyzing Words Versus Deeds" *Journal of Industry, Competition and Trade* 24 (10).

[13] Global Energy Monitor (Mar. 2024). "In China, a small boost to low-emissions steelmaking can mean big cuts to its carbon footprint".

Our interviews highlighted the largely opportunistic political momentum built around the IRA, adopted as a reconciliation bill.[14]At the EU level, the gradual commitment to a European industrial policy agenda has largely been the result of successive economic and political crises since the early 2020s. It was initiated with the new industrial strategy for Europe in March 2020, updated in 2021 and further developed with the Green Deal Industrial Plan for the Net-Zero Age in February 2023, partly adopted as a response to the American IRA. The Clean Industrial Deal (February 2025) represents the latest stage of this growing European commitment to industrial policy, although built on an unclear Union competence. To a large extent, the European strategies aim at coordinating multiple and previously disconnected policies (trade, innovation, competition, economic policies) in a consistent framework towards common objectives: improving European competitiveness in future-oriented sectors (especially clean technologies), tackling climate change, and strengthening the security of European value chains. It also defined new instruments such as a much broader competence for economic security and the provision of critical minerals (with the Critical Raw Material Act [CRMA] in 2024). Two EU policy instruments have been more actively used to support and fund industrial deployment. The IPCEIs and the Innovation Fund emerged as central vehicles to provide and coordinate support on top of national initiatives, although IPCEIs rely on Member States' aid, mostly at the innovation and early-deployment stages. Since 2021, an increased number of IPCEI have been launched and an extension of MS participation is notable with, in particular several of them focused on the battery and hydrogen industry, both important value chains for decarbonization. For its part, the Innovation Fund, benefiting from a fresh influx of money due to the new ETS rules and the increase in CO_2 price, has become a new "financial arm" to fund industrial projects and developed a specific hydrogen bank to fund projects in this value chain specifically. The 2025 Clean Industrial Deal goes one step further, following the 2024 Draghi's report, by proposing the constitution of a new "competitiveness fund" along with several other initiatives on energy, trade, lead markets and circular economy. This political agenda has similarities with other countries' strategies, including setting clear environmental targets (mostly through the development of the "Fit for 55" package) and committing to the development of green industries. However, the EU does not have the fiscal tools, nor the competence, to clearly define a technological or sectoral planning at the continental level. European action mostly relies on legislation (the so-called "strategic projects" of the critical raw material act and the Net-Zero Industry Act), relaxed state-aid control (including updated guidance on the "important projects of common European interest" – IPCEI), and the fiscal space offered by the NextGenerationEU Fund, which has partly been a trigger for new industrial policies at Member State level. In order to grasp a full picture of European industrial policy, we must open the box of Member States' specific strategies. (**Figures 1** and **2**)

1.2. Within Europe, a rising wave of industrial strategies with a significant green component

The 6 EU Member States covered in our study illustrate industrial strategies defined in different contexts, but it is remarkable that they all mark a shift away from the previous liberal economic policy paradigm towards a more interventionist state, embraced simultaneously by multiple EU Member States, with similar objectives. NextGenerationEU funds were mobilized in many EU countries to support industrial sectors and were even a clear launching pad for Spain and Italy, where the national recovery and resilience plans provided an opportunity for formulating new long-term industrial strategies. Chapter 12 of the *Plan de Recuperación, Transformación y Resiliencia* (PRTR) explicitly targeted an "Industrial Policy in Spain 2030"[15] and the *Piano Nazionale di Ripresa e Resilienza* (PNRR) contained many support schemes relevant for industrial sectors. The two industrial strategies aimed to achieve structural changes, by improving the competitiveness of firms (mostly through investments in research and innovation, especially targeted towards small and medium enterprises, and infrastructure deployment) and targeting specific sectors, notably the green industries. In Spain, the deployment of green hydrogen (and more generally renewable energies) is particularly emphasized, along with the electric vehicle industry. Italy has a less sectoral policy, rather favouring energy efficiency and digital empowerment of companies. In both countries, these strategies framed under a European umbrella were complemented by subsequent national initiatives: the draft law on Industry and Strategical autonomy in Spain (Proyecto de Ley de Industria y Autonomía Estratégica) approved by the government in December 2024; and the green book on industrial policy released by the Italian Ministry of Industry and Made in Italy (MIMIT) in October 2024 in anticipation of a more strategic white book on industrial policy planned for 2025.

Germany developed its own national industrial strategy document, distinct from its reconstruction and resilience plan. Based on an overview of the current state of German industry, it aims to explain the economic and political relevance of policy tools (regulatory simplification, infrastructure development, financial support etc.) for responding to new challenges of changed times (*Zeitenwende*). Although the timing of this communication (October 2023) suggests that it has not necessarily guided the previous three-party coalition on its industrial policy, it provides a (*ex post*) rationale for the significant support

[14] Reconciliation Bill is an American special legislative instrument used to fast-track the vote of a bill with a single majority in the Senate and other simplification rules (Senate debate time is limited, only certain kinds of amendments can be offered) on restricted legislative matters, relating to changes in spending or revenues.

[15] Although other components in the PRTR are also relevant to the industrial sectors: BNP Paris estimated in 2021 that about a quarter of total investments supports industrial sectors ("Spain: the tortuous path to reindustrialization", BNP Paris Economic Research, Eco Conjoncture n°7, September 2021).

packages offered or considered for the German industrial sector: the risk of deindustrialization due to (temporarily) high energy prices that may have significant social impact, the need to secure global value chains, the environmental challenge and its effect on competitiveness when third-party countries do not adopt similar environmental regulation (especially a low carbon price). It is still unclear to what extent the next CDU-CSU-led coalition will remain committed to this agenda but Friedrich Merz's initial announcement to dedicate a fifth of a €500 billion infrastructure fund to the Climate and Transformation Fund heads in this direction with possible changes in policy tools mobilized.

The other European countries in our benchmark rather rely on a patchwork of different strategies, documents and political discourse rather than a single document that synthesizes their national industrial strategy. The French industrial policy was mostly depicted in a speech by Emmanuel Macron on 11 March, 2023 on "Accelerating [the French] industrial reconquest", complemented by other pieces such as the France 2030 strategy, the recovery and resilience plan "France Relance" and sectoral decarbonization roadmaps. This speech highlights similar challenges to German or US industrial policies (risks to supply chains, socio-economic problems related to deindustrialization, the need to innovate and invest in future-oriented sectors while decarbonizing industries) and France 2030 appears to be the main vehicle for tackling these challenges. France also adopted in 2023 a new Green Industry Law directly responding to the American IRA's tax credits in limited clean tech sectors. An interesting feature of the French industrial strategy framework is the multiple works defining national decarbonization roadmaps with technical, environmental and economic objectives (such as the national low carbon strategy, reports by public bodies such as ADEME or private actors such as RTE). Eventually, a General Secretary for Environmental Planning (SGPE) was created in 2023, responsible for the definition and coordination of decarbonization roadmaps. The government also incentivized private actors to seize the opportunity to define sectoral decarbonization roadmaps, with the support of the General Direction of Enterprises (DGE), highlighting in particular 50 highly emitting industrial sites. This coordination is organized within the National Council for the Industry (CNI) but the relatively top-down approach has led to mixed results according to our interviews.

In Sweden, in response to the rapid industrial development in northern regions, the government adopted a regional *Strategy for New Industrialization and Social Transformation in Norrbotten and Västerbotten Counties* (June 2024). This strategy mostly aims at tackling the technical (such as the development of the electric grid and production capacities) and socio-economic challenges (such as providing sufficient housing or bringing adequate skilled workers in these regions) to match new industrial development. It was preceded by a national *Strategy for Sweden's Trade, Investment and Global Competitiveness* (November 2023), heavily focused on innovation for competitiveness and being export-oriented. However, our interviews highlighted that in Sweden, what is now designated as industrial policy (such as the support for industrial decarbonization) was rather termed environmental policy and adopted as a follow-up to the Paris Agreement and the subsequent reinforcement of climate targets at the national and EU level. Accordingly, different economic sectors have defined clear decarbonization roadmaps through the Fossil Free Sweden Initiative as early as 2019. In total, 22 different industries have produced their own roadmaps describing how they can achieve a net-zero objective by 2045, highlighting the key challenges and how the State can support their initiatives. On top of this, six transversal strategies were defined for tackling common challenges across all industries. Public policies have supported relatively early important projects such as Hybrit, aiming at producing green steel, or the decarbonization of LKAB iron-ore mining activities.

The Civic Coalition government in Poland (elected in 2023) has not adopted any specific national or regional industrial strategy. However, the previous PiS government adopted in June 2021 the *Polityka Przemyslow Polski* (PPP), a strategy paper focused on industry with five axes of development in the post-covid world: digitization and industry 4.0, the greening of industry, securing supply of key raw materials, shortening and reshoring of supply chains and the knowledge and skills challenge. The national resilience and reconstruction plan is also focused on infrastructure deployment and more specifically on the greening of power generation with the deployment of significant renewable energy production units (especially a large offshore wind project in the Baltic Sea, a project of nuclear power generation plant, and support for the deployment of rooftop solar panels) and the decarbonization of domestic heating (replacement of coal-fired district heating with alternative decarbonized solutions, and support for thermal renovation of buildings).

Overall, there is a clear movement towards a renewal of industrial strategy in industrialized countries. All countries, and especially the EU and its Member States, focus on green industrialization and other "new" objectives (with respect to the traditional competitiveness or infant-industry arguments), such as securing global value chains. In the EU, this has led to passing new legislation, the NZIA and the CRMA are clearly designed for industrial policy and other policies related to economic, regulatory or environmental provision and for Member States to take the NextGenerationEU recovery plan as a carrier to support industrial priorities, among them, the twin digital and green transitions.

Finally, within Member States, new institutions and policy process—sometimes still in the making, as is the case in Italy and Spain—are emerging, relating decarbonization planning and industrial development with different levels of attribution in establishing strategic documents, engaging with stakeholders and recommending or defining public policies. So far these national processes tend to be largely disconnected from the existing debate at EU level on the coordination of industrial policies that emerged in the context of the Clean Industrial Deal, with notably the creation of a competitiveness coordination tool to coordinate the action of Member States, the creation of "Clean Transition Dialogues" organized by sectors of the economy between the European Commission and industry stakeholders and the upcoming Net-Zero Europe Platform for the implementation of the Net-Zero Industry Act (NZIA).

2. INDUSTRIAL POLICY TOOLS: MUCH MORE THAN (CORPORATE) SUBSIDIES

KEY TAKEAWAYS

Industrial policies were built on the back of long-existing innovation and environmental policies that already relied strongly on state intervention: support for R&D, carbon pricing or public subsidies supporting the demand for clean technologies. These policies form the root for a green industrial policy that ultimately aims at improving productivity, competitiveness and achieving environmental targets. Nonetheless, these "historical" pieces have recently evolved to better reflect the new objectives such as stronger sectoral allocation, securing global value chains, avoiding unfair global competition and environmental dumping associated with industrial policies.

Support for R&D&I remains the backbone of industrial policy. All countries in our benchmark have some form of support for innovation, especially through tax credits that were increased in recent years in certain countries, which is the case for the pre-tax super deduction tax credit of R&D expenses reaching up to 200% in China in 2023. Other initiatives involve more targeted funds supporting specific sectors mostly through competitive tenders, especially for clean technologies, such as the Green Innovation Fund in Japan or the France 2030 plan aiming at achieving a repositioning of the French industrial base towards higher value-added and more innovative sectors.

While implementing its climate commitments, the EU has adopted a reform to significantly strengthen its domestic industrial carbon pricing mechanism, the ETS market price applying to energy and industrial sectors that now has a more stable and significant CO_2 price (around 70€/tCO_2 in 2024). In an international context in which the EU remains the main region pricing industrial CO_2 emissions, this increases the risk of carbon leakage that the EU attempts to address with the recent reforms of its ETS market and the introduction of the carbon border adjustment mechanism (CBAM). In parallel, South Korea, Japan and China have taken initiatives to improve and develop their own domestic industrial CO_2 pricing with the intention to extend their coverage to a larger share of emissions and increase the level of their carbon prices in the coming years. These initiatives could open an avenue for greater coordination with the EU in the context of the coming into force of the CBAM.

In order to accelerate the uptake of cleaner products, many governments have long adopted demand-support mechanisms, in order to compensate for the so-called "green premium"—the additional cost of cleaner products—and develop their market penetration. These demand-support mechanisms have been constantly evolving in different contexts following different justifications. A first reason has been to take into account the decline in the cost of production for clean technologies, which may now offer a competitive offer on markets, a good example of this would be the support for renewable electricity production. New sectors/technologies have on the contrary seen a development of such demand-side mechanisms such as industrial decarbonization, hydrogen or the electrification of transport.

Rising criticisms against demand-side schemes highlight that they often indiscriminately support foreign and national production, partly subsidizing industrial development in other countries. As a consequence, subsidies for green products have seen a recent decline in some countries: the ecological bonus for clean vehicles was scrapped in Sweden in 2022, in Germany in 2023 and not renewed after 2024 in Italy. The amount of subsidy was also significantly decreased in France and the RoK in 2025. This also leads to a rethinking of the policy-design for demand-side instruments with increased considerations for environmental, socio-economic or local requirements attached to the policy support mainly in the US and the EU.

2.1. R&D&I and clean technologies

Innovation policy is the backbone of industrial policy and is a common support provided to companies to foster national competitiveness.[16] In all countries, recent industrial policies have maintained this focus on innovation and R&D, through tools incentivizing companies to invest in R&D such as tax credits. Such incentives were maintained and even deepened in China and the RoK in recent years. In the RoK, the R&D tax credit was increased on national strategic technologies with the revision of the Restriction of Special Taxation Act (March 2023), increasing the tax credit rate of up to 60% of eligible expenses for SMEs in 2024 (50% for middle-market enterprises and 35% for major companies). In China the pre-tax super deduction of R&D expenses was increased from 75% to 100% for manufacturing in 2021 and up to 200% for eligible expenses in March 2023.

[16] These policies were typically encouraged by international economic organization such as the OECD, see for example: OECD (2015). *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*, OECD Publishing, Paris. For a review of innovation policies see OECD (2020). "The effects of R&D tax incentives and their role in the innovation policy mix: Findings from the OECD microBeRD project, 2016-19", *OECD Science, Technology and Industry Policy Papers*, No. 92, OECD Publishing, Paris.

The increased political directionality of new industrial policies has fostered the emergence of "green funds" directed towards green innovation. One example of such a green fund is the Japanese Green Innovation Fund granted more than 2 trillion yen (approx. $14 billion), as part of its Green Growth Strategy, operated by the New Energy and Industrial Technology Development Organization (NEDO). It was created in October 2020 in the aftermath of the Japanese net-zero pledge for 10 years and supports 14 priority fields[17] for which implementation plans have been formulated within the Green Growth Strategy. Projects must be sizeable (more than 20 billion yen—about $130M), long term, carried out by companies or profit-making businesses and include innovative and fundamental R&D elements. The support provided to R&D projects continues further down to the scaling up of manufacturing capacities, and the demonstration and installation stage of innovative technologies.[18] This illustrates an important feature of these new "green funds": they tend to blur the difference between innovation and scale-up policies. Support is provided not only at the R&D, or the demonstration stage, but also at the stage of implementation of "first-of-a-kind" project or the building of innovative plants for industrialization.

These types of funds are not new and build on previous experiences. For example, in Germany, the Environmental Innovation Programme (UIP) has been supporting since 1979 initiatives promoting innovative large-scale technical pilot projects, well suited for demonstration purposes (not yet implemented on the market) and hence for replication, that sustainably relieve the environment.[19] The support mechanism is always open to application and can either be grants of up to 30% of eligible costs or loans with reduced interest rates. It targets in priority small and medium-sized businesses.

There is however a growing overlap between innovation support and the deployment of clean technologies manufacturing capacities. This feature largely relates to the need to provide support to bridge innovations with the market, and provide more continuity in public support in the "valley of death" (the same logic also applies to the European Innovation Fund). The France 2030 programme[20] was initially developed as an investment plan for seeding the emergence of future-oriented sectors. By defining ten key objectives, based on a review of "cutting-edge technologies",[21] and six transversal "levers", this €54 billion investment programme[22] aimed at investing in "high risk-high social yield" innovative projects, with at least 50% of investments directed towards environmental objectives. Through these investments, the government tried to reposition the French industrial base towards sustainable, highly technological and high value-added industrial sectors. This ambition translated into competitive tenders directed towards innovative clean technologies (the DEMO-TASE and TASE-PME tenders for example). However, France 2030 has progressively integrated other types of instruments supporting industrial transition in declining sectors (such as the "*Rebond Industriel*" call for applications supporting transition in the transport industry), local economic support at the regional level (so-called "*France 2030 territorialisé*") and the development of production capacities (with the ongoing "First Plant" tender),[23] moving from an innovation-focused programme to a broader industrial policy programme that follows wider objectives.[24] (**Figure 3**)

By contrast with this innovation-based approach, the US provides relatively smaller federal support for green innovation, compared to the support provided to manufacturing. The IRA is focused on providing production or investment tax credits for the deployment of clean technologies, and subsidies for decarbonization projects mostly through the Greenhouse Gas Reduction Fund. This difference can partially be explained by the involvement of States (such as the New York Green Innovation Grant) and significant private funding opportunities through venture capital in funding innovation. There are still federal funding opportunities for innovation, such as the competitive tenders operated by the Office of Energy Efficiency and Renewable

17 Energy related industries (offshore wind power, solar and geothermal industries; hydrogen and fuel ammonia industry; next generation heat energy industry; nuclear industry), transport and manufacturing industries (automobile and battery industries; semiconductor and information and communication industries; shipping industry; logistics, people flow, and civil engineering infrastructure industries; food, agriculture, forestry, and fisheries; aircraft industry; carbon recycling and materials industry), home/office related industries (housing and building industry and next-generation power management industry; resource circulation-related industries; lifestyle related industries)

18 For example, the GIF supports the development of next-generation solar cell development (perovskite solar cells). The total support is 49.8 billion yen (about $ 340 million) and supports the research stage for combinations of raw materials achieving high performance of solar cells, the development of manufacturing technology for scaling up and mass production and the actual installation on walls of buildings to test their performance. See other examples of projects following that link: https://www.meti.go.jp/english/policy/energy_environment/global_warming/gifund/index.html [accessed on 8 April 2025].

19 Projects must be in areas of water treatment, waste prevention, circular economy, soil protection, air pollution control, reduction of noise and vibrations, energy saving, resource or material conservation and efficiency.

20 See : https://www.info.gouv.fr/grand-dossier/france-2030-en [accessed on 8 April 2025].

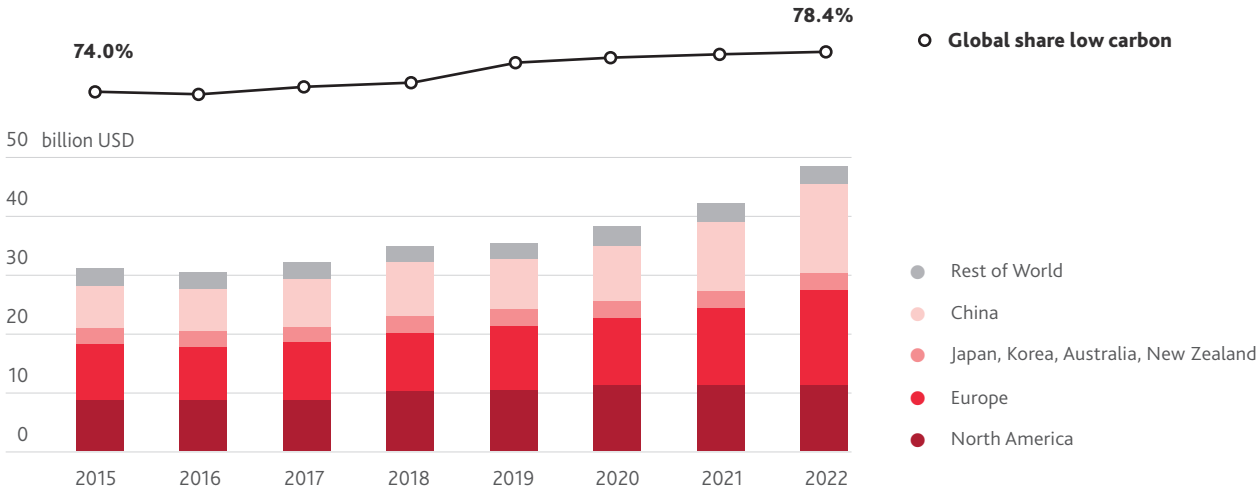
21 « Faire de la France une économie de rupture technologique – Soutenir les marchés émergents à forts enjeux de compétitivité », Collège d'experts présidé par Benoît Potier, 10 February, 2020.

22 Initially, the plan was presented on 12 October, 2021 with a total budget of €34 billion (https://www.elysee.fr/emmanuel-macron/2021/10/12/presentation-du-plan-france-2030) and was mixed with the fourth Plan d'Investissement d'Avenir (PIA 4), granted with €20 billion, in April 2022, within a single investment plan (which corresponds to the current France 2030 plan) worth €54 billion.

23 This tender aims to support projects of new pilot plants and/or industrial production aiming at commercialize innovative products see https://www.bpifrance.fr/nos-appels-a-projets-concours/appel-a-projets-france-2030-premiere-usine [accessed on 8 April, 2025].

24 Although the 10 landmark objectives remain the same. They are gathered within 3 overall objectives of "Producing better" (5 objectives: producing small modular reactors, become a leader in green hydrogen, decarbonize industry by reducing GHG emission by 35%, produce 2 million electric and hybrid vehicles before 2030, produce the first low-carbon aircraft), "living better" (3 objectives: invest in healthy, traceable and sustainable food, produce 20 biomedicines against cancers and chronic diseases, become a leader in cultural and creative content) and "better understand the world" (2 objectives: invest in a new spatial venture and invest in seabed understanding).

Figure 3. Global public energy RD&D budget with share of low-carbon 2015-2024



Source: IEA, *Energy Technology RD&D Budgets*, accessed 20/10/25

Energy (EERE) or the ARPA-E agency, created in 2019. The CHIPS and Science Act has also authorized the funding of $11 billion for basic research programmes relevant to energy and climate research but this is not directly targeted towards private R&D programmes.

2.2. Carbon pricing initiatives

A further strong commonality relevant to industrial policy is the development of carbon markets. Although carbon pricing relates more to environmental than to industrial policy, it is a highly relevant factor as it contributes to significantly increases input costs and may impact the relative competitiveness of manufacturing in different locations, especially for carbon and energy intensive industrial processes. A global coordination of carbon pricing would be in theory desirable for achieving decarbonization while maintaining a fair global competition and mitigating environmental dumping. However, carbon pricing mechanisms have historically not developed at the same pace everywhere and have been much more developed in the EU.

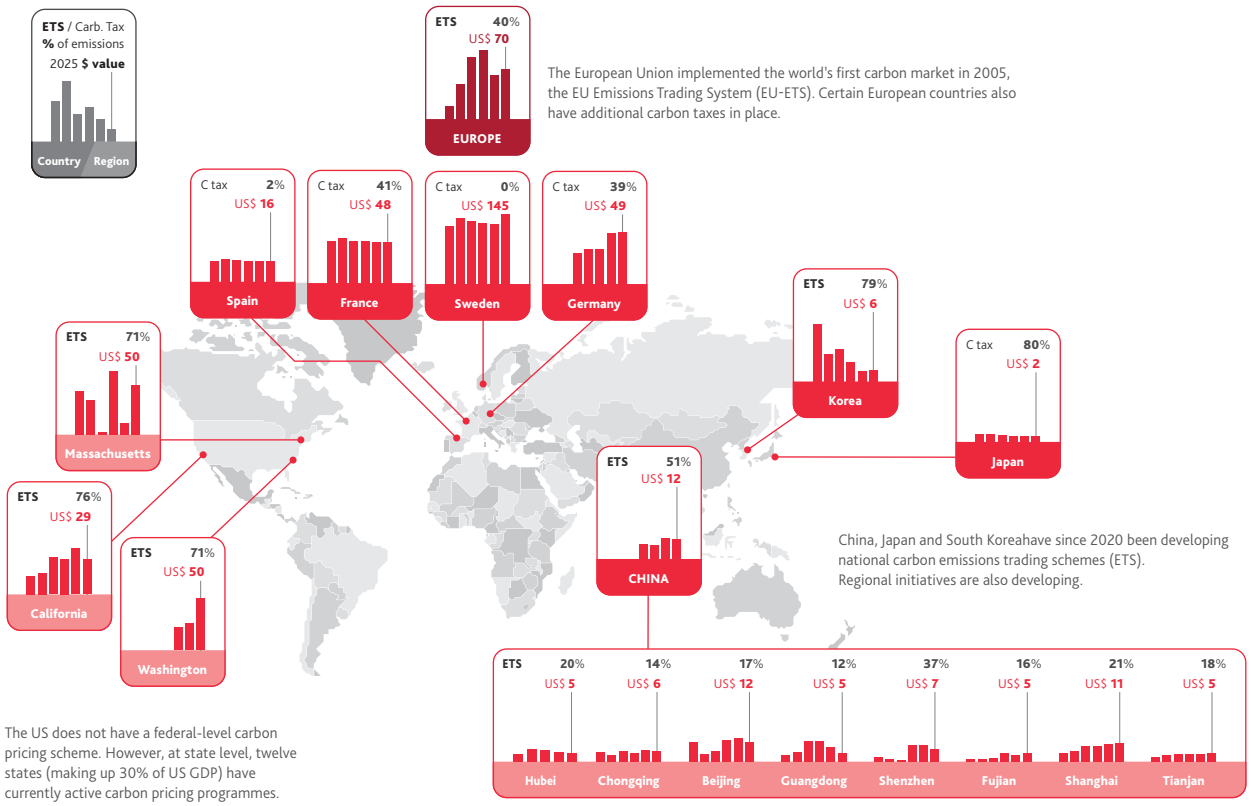
The European Union implemented the world's first carbon market in 2005, the EU Emissions Trading System (EU-ETS) covering emissions from electricity and heat generation, industrial manufacturing (including oil refineries, steel works, and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals), and has since been then extended to maritime and aviation transport. The scheme's impact on the international competitiveness of industries has been addressed from the outset by allocating a certain number of allowances free of charge to industries, based on performance benchmarks, to reduce the risk of carbon leakage.

In 2021, the "Fit for 55" Package reinforced the ambition of the EU's climate objectives as the emissions reduction target changed from -40% to -55%. This led to a revision of the parameters of the ETS and a substantial increase of the price of carbon (from 20€/tCO_2 to 60-90€/tCO_2 between 2021 and 2024). A new Carbon Border Adjustment Mechanism (CBAM) was also adopted to address the problem of carbon leakage, i.e. to mitigate the risk of companies relocating their production outside of countries covered by the EU-ETS to avoid carbon pricing. It aims to ensure that importers of carbon-intensive goods pay the same carbon price as European industrial actors. When importing into the EU, producers must pay a price for the emissions embedded in the production of their goods. It is expected to progressively replace free allocations for the sectors covered by its implementation, namely cement, iron and steel, aluminium, fertilisers, electricity and hydrogen, which together, represent 50% of EU industrial emissions covered by the ETS that are prone to carbon leakage. The implementation of the CBAM starts with a transitional phase (2023-2025), the CBAM will progressively enter into force between 2026 and 2034 while free allocations for EU producers in the covered sectors will be phased out in parallel. Because it will directly affect imports into the EU market of industrial products, the CBAM implementation has been a topic of debate between the EU and other countries since 2021 and was often referred to as a justification to push carbon pricing policies or more broadly industrial policies in other geographies.

Since the net-zero carbon pledges in China, Japan and South Korea (in 2020 for all three countries), there have been developments in their nascent national carbon emissions trading schemes (ETS).

RoK was the first country in Northeast Asia to introduce a mandatory nation-wide ETS market (the K-ETS) in 2015. It covers six sectors (heat and power, industry, buildings, transportation, waste, public sector), covering 73.5% of South Korea's national GHG emissions. However, emission allowances are mostly

Figure 4. Carbon pricing systems



Source: World Bank, Carbon Pricing Dashboard, accessed 28/10/25.

allocated for free[25] and there has been an oversupply of allowances at the beginning of the third implementation phase (2021-2025). As a result, the price of emissions allowances fell from \$30/tCO_2 in February 2022 to \$8/tCO_2 at the end of June 2023. The Ministry of Environment unveiled in September 2023 a plan to stimulate the Korean Emission Trading Scheme, as part of a broader reform aimed at increasing the scheme's liquidity.[26] The upcoming Phase 4 (2026-2030) basic plan and allocation plan is set to be released by the Ministry of Environment by June 2025 and should align with Korea's more ambitious 2030 GHG emission reduction target set out in the most recent Nationally Determined Contributions (NDC): a 40% reduction by 2030 compared to 2018 levels.[27]

In China, the national ETS started operating in 2021 although it was already planned in the 12th Five-Year Plan (FYP, 2011-2015). The scheme was initially limited to the power sector. As of March 2025, it includes the steel, cement and aluminum sectors, now covering about 60% of Chinese national GHG emissions. For these last three sectors, the scope is limited to direct GHG emissions, and in the first year, allowances will be based on verified 2024 emissions, with these emissions equaling the freely allocated allowances. In 2026 and 2027, allowances will be based on carbon intensity and output of the companies. After 2027, benchmarks will be established and allocations will be gradually tightened.[28] The Chinese ETS market aims to be a central piece of the new Work Plan for Accelerating the Establishment of a Dual-Control System for Carbon Emissions,[29] a new reporting system for companies on carbon intensity and the gradual measurement of total emissions that should be

25 90% of emissions allowances for the power sector are freely allocated and 10% paid for in auctions.

26 For details on these measures see the article by Kim & Chang: "New Measures to Stimulate the Korean Emission Trading Scheme", 5 December, 2023: https://www.kimchang.com/en/insights/detail.kc?sch_section=4&idx=28418 [Accessed on 11 April, 2025].

27 Consistent with these reforms, the Ministry of Environment has decided to cancel the February 2025 auction of ETS allowances to reduce the oversupply. See the article by Himanshu Chauhan in S&P Global: "South Korea expands ETS to enhance market effectiveness, may cancel Feb auction to curb oversupply", 7 February, 2025. https://www.spglobal.com/commodity-insights/en/news-research/latest-news/energy-transition/020725-south-korea-expands-ets-to-enhance-market-effectiveness-may-cancel-feb-auction-to-curb-oversupply [Accessed on 11 April, 2025].

28 For more details on the Chinese work plan released by the Ministry of Ecology and Environment on 20 March, 2025 see: https://icapcarbonaction.com/en/news/china-officially-expands-national-ets-cement-steel-and-aluminum-sectors [Accessed on 11 April, 2025].

29 The dual control system for carbon emissions was announced on 2 August, 2024 and outlines a "3-step roadmap" to build the dual control system for carbon emissions. See "Work Plan for accelerating the establishment of a Dual Control System for Carbon Emissions" Climate Cooperation China on behalf of the International Climate Initiative (IKI), 5 August, 2024.

TABLE 1. Carbon pricing systems

JURIDICTION	INSTRUMENT NAME	STATUS	SHARE OF JURISDICTION EMISSIONS COVERED	SHARE OF GLOBAL EMISSIONS COVERED	PRICE ON 1 APRIL	2019	2020	2021	2022	2023	2024
European	EU ETS	Implemented in 2005	38%	2.59%	€57.03 (US$61.30)	21.81	16.95	42.38	78.29	88.55	57.03
European	EU ETS2	Under development since 2023									
France	France carbon tax	Implemented in 2014	40%	0.32%	€44.60 (US$47.94)	44.6	44.6	44.6	44.6	44.6	44.6
Germany	Germany ETS	Implemented in 2021	39%	0.57%	€45 (US$48.37)			25	30	30	45
Poland	Poland carbon tax	Implemented in 1990	24%	0.18%	Not available*	0.3	0.3	0.31	0.32	0.34	
Spain	Spain carbon tax	Implemented in 2014	1.90%	0.01%	€15 (US$16.12)	15	15	15	15	15	15
Sweden	Sweden carbon tax	Implemented in 1991	40%	0,05%	SEK1,368.30 (US$127.26)*					1,150.42	1,368.30
China	China national ETS	Implemented in 2021	31.90%	9.30%	RMB90.97 (US$12.57)				58.5	56	90.97
Japan	Japan carbon tax	Implemented in 2012	80%	1.51%	JPY289 (US$1.91)	289	289	289	289	289	289
South Korea	Korea ETS	Implemented in 2015	89%	1.20%	KRW8,490 (US$6.30)	26,65	40,00	18,00	22,70	14,65	8,49

Source: World Bank, Carbon Pricing Dashboard, accessed 28/10/25.

implemented during the 15th FYP (2026-2030). However, there are still significant technical challenges related to the implementation of the Chinese ETS, which the new work plan aims at addressing. An oversupply of allowances has led to a very low carbon price (though carbon prices have steadily increased, breaching the 100 yuan ($14.05) per tonne mark for the first time in 2024). The data collection remains the primary challenge in the power sector, with risk of fraud, in emissions accounting.[30] Japan has recently been working on implementing carbon pricing in the context of the development of the GX framework. It relies on a two-legged "pro-growth pricing concept": public investments with GX Transition Bonds for financing the transition and the gradual implementation of carbon pricing with the GX-ETS, a new trading scheme that will be implemented in four phases. First, a new emissions trading market was launched in April 2023 on a voluntary basis: member companies of the "GX League" are evaluated on a "pledge-and-review" basis. They set reduction targets for 2025 and 2030 for both direct and indirect emissions, monitor and then report their emissions (reviewed by a third party). When reductions surpass the targets, companies can sell the surplus emission reductions; if they fail, they can buy credits from other participants. This mechanism is set to become mandatory from FY 2026 onwards for all listed companies, with potential measures to improve carbon price predictability by incorporating a gradual and medium- to long-term carbon price trajectory. From FY 2028, a new "GX Surcharge" will be introduced on fossil fuel importers in order to apply the carbon pricing scheme to all emissions equally (with potential measures to avoid dual payment). Finally, from FY 2033 onwards, an auctioning system (based on the example of the EU ETS market) will be implemented for power generation utilities only, with an emissions quota proportional to the initial volume of emissions and free allowances, gradually decreased based on efficiency benchmarks and other factors.

[30] According to Carbon Brief this was one of the principal reasons that the original launch of the ETS was delayed: Anika Patel "Explainer: China's carbon market to cover steel, aluminium and cement in 2024", 23 September, 2024 https://www.carbonbrief.org/explainer-chinas-carbon-market-to-cover-steel-aluminium-and-cement-in-2024/ [Accessed on 11 April, 2025].

Conversely, the US is not moving towards a federal-level carbon pricing scheme despite it having been discussed for the past two decades. However, at state level, twelve states[31] (making up 30% of US GDP) have currently active carbon pricing programmes. According to the OECD, in 2021 the US priced about 41% of its carbon emissions from energy use, and about 5% were priced at an effective carbon rate above €60 per tonne of CO_2.[32] The Regional Greenhouse Gas Initiative (RGGI) covering 10 of the Northern states covers only the power sector and had an average allowance price of about $18 in 2024.[33] The Californian ETS market covers about 76% of State's emissions (agriculture, mining, transport, building, industry and power sectors) with an average auction price of $35 in 2024.[34] **(Table 1)**

2.3. Demand-side support policies

Many countries in our study have long-existing plans to incentivize the take-up of green technologies as part of their environmental policies. Indeed, many of these technologies, although less emitting than alternative solutions, face a "green premium" due to GHG prices not being internalized, which renders technologies relying on fossil fuels less expensive and more competitive.

Historically, the development of clean energy capacity and the production of renewable energy have been subsidized through feed-in tariffs (FITs). Such feed-in tariffs for renewables have existed since 2000 in Germany (EEG) and were implemented in 2008 in China under the framework of the Renewable Energy Law and were then generalized across Europe. Spain and Italy were among the early leaders, offering very generous FITs in the early 2000s, which led to a rapid, though ultimately financially challenging, buildout of solar PV. The US has largely relied on federal and state-level tax incentives, such as the Production Tax Credit (PTC) for wind and the Investment Tax Credit (ITC) for solar, to drive deployment. Japan also introduced a FIT scheme after Fukushima in 2012 to rapidly diversify its energy mix towards solar and wind while France also developed FIT before switching to auction systems for its growing solar and wind sectors. Support for the development of renewable energy was also encouraged via regulation or incentives through green finance (for example, initiatives like the RE100,[35] a global initiative aimed at bringing together businesses using 100% of renewable energy in their operations). For example, in Korea, a renewable portfolio standard (RPS) was introduced in 2012 and mandates that power generators with installed capacity over 500MW (25 companies accounting for 72% of total energy generation in 2021) must increase the share of renewable energy in their electricity mix to 25% by 2030. The RPS requirement for 2022 has been revised upward in April 2021, from 10% to 12.5% to accelerate the installation of renewable energy. In the US, 36 states have adopted Clean Energy and Renewable Portfolio Standards with varying objectives of renewable energy generation (e.g. 60% by 2030 in California against a voluntary target of 10% by 2025 in Indiana).[36]

Similarly, the development of a clean vehicle fleet has been supported through various incentives. In China, subsidies for clean vehicles were offered as early as 2009 through the Electric Vehicle Subsidy Scheme covering all categories of EVs (HEV, PHEV, BEV and FCEV) with up to 60,000RMB for BEVs (about USD $9,000), first implemented in 14 pilot cities and deployed nationwide in late 2012.[37] A distinctive feature of purchase subsidies in China was that they were paid out directly to manufacturers only for electric vehicles produced in China and are reported to have had an important role in the development phase of the sector.[38] In the US, the Energy Improvements and Extension Act adopted in late October 2008 (following the global financial crisis outbreak), created a new tax credit of up to USD $7,500 for plug-in hybrid vehicles, expected to go on sale in 2010. In May 2009, the Japanese Diet passed the "Green" Vehicle Purchasing Promotion Measures providing incentives to purchase fuel-efficient vehicles with a subsidy of up to 250,000YEN (about USD $2,500) with the replacement of an old car (13 years or more).[39] Across Europe, countries primarily employed direct grants. France introduced a Bonus-Malus system in 2008, which penalized high-emitting cars while granting an "Ecological Bonus" for low-emission ones, an incentive that has been repeatedly adjusted over time to adjust to the performance of new cars and to benefit more low-income households. Italy and Spain have historically implemented scrappage schemes (trading old cars in for new EVs) alongside direct purchase incentives to stimulate the uptake of cleaner cars. The development of a clean vehicle fleet is also supported by regulation, especially in the EU. The European regulation on CO_2 emission performance standards for new passenger car and light commercial vehicles was updated in April 2023 and schedules a de facto ban on internal combustion vehicles by 2035. Similarly, EV quotas

31 California, Washington, and the eleven Northeast states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

32 OECD (2024). *Pricing Greenhouse Gas Emissions 2024: Gearing Up to Bring Emissions Down*, OECD Series on Carbon Pricing and Energy Taxation. Country Notes - Carbon pricing in the United States.

33 International Carbon Action Partnership https://icapcarbonaction.com/en/ets/usa-regional-greenhouse-gas-initiative-rggi [Accessed on 11 April, 2025].

34 International Carbon Action Partnership https://icapcarbonaction.com/en/ets/usa-california-cap-and-trade-program [Accessed on 11 April, 2025].

35 https://www.there100.org/ [Accessed on 29 May, 2025].

36 See the State Climate Policy Dashboard: https://www.climatepolicydashboard.org/policies/electricity/clean-energy-standard [Accessed on 29 May, 2025].

37 Han Hao, Xunmin Ou, Jiuyu Du, Hewu Wang, Minggao Ouyang (2014). "China's electric vehicle subsidy scheme: Rationale and impacts", *Energy Policy*, Volume 73, Pages 722-732,

38 Bickenbach, Frank, Dirk Dohse, Rolf J. Langhammer, and Wan-Hsin Liu (Apr. 2024). "Foul Play? On the Scale and Scope of Industrial Subsidies in China" KIEL Policy Brief, No. 173. Zhang, Tong, Paul J. Burke, and Qi Wang (2024). Effectiveness of Electric Vehicle Subsidies in China: A Three-Dimensional Panel Study. *Resource and Energy Economics* 76: 101424.

39 https://www.jama.org/japanese-government-incentives-purchase-environmentally-friendly-vehicles/ [Accessed on 29 May, 2025].

for carmakers in China and the RoK also represent constraining rules for domestic manufacturers.

Nonetheless, as renewable energies and clean vehicles are becoming increasingly competitive against fossil-fueled alternative technologies (especially in the case of renewable energy generation with solar PV), some countries are currently lowering their sectoral subsidies. In 2024, IRENA estimates that the levelized cost of electricity (LCOE) of solar technologies has dropped by 90% over 13 years (from 0.460 USD/kWh in 2010 to 0.044 USD/kWh in 2023) and 70% for wind power electricity (from 0.111 USD/kWh in 2010 to 0.033 USD/kWh in 2023).[40] China will phase-out the current feed-in tariff system in favour of market-driven pricing starting in June 2025. The joint Norwegian-Swedish electricity certificate scheme was also phased out in December 2021, having achieved the common target of 28.4 TWh of renewable energy production capacity. The support mechanism for small rooftop PV modules (with peak power below 500 kWc) is currently under intense deliberation in the French context.[41] More generally, this marks the final achievement of a gradual trend that has been underway for several years, especially in the EU, where administrative feed-in tariffs moved to competitive auctions in 2014[42] and public policies are now focused on fostering power purchase agreements (PPAs) between private off-takers and developers. For clean vehicles, despite a clear decreasing trend in production costs (especially in China), internal combustion engine vehicles often remain more competitive and public support mechanisms are still key drivers in clean vehicle uptake. In China, the support for clean vehicles was phased out by the end of 2022 and the government instead imposed a mandate on car manufacturers that a certain percentage of all vehicles sold annually must be battery powered (the RoK has also adopted similar sales quota of 15% of annual sales since 2020).[43] However, a subsidy was reintroduced in April 2024 with a new trade-in programme offering up to 10,000 yuan (USD $1,400) to buyers who trade-in older cars for new BEVs or PHEVs before the end of the year[44]. The programme was continued in 2025.[45]Support schemes for renewable energy were also criticized for indirectly subsidizing foreign (and more specifically Chinese) production of green technologies. In 2022, the IEA estimated that China accounted for 80% of all manufacturing stages of solar panels.[46] Similarly, public subsidies for clean vehicle purchases are criticized for being expensive and insufficiently targeted towards European (national) production and are therefore being removed or new initiatives are being taken to limit the scope of these subsidies. Indeed, in 2024 China accounted for more than 70% of global electric car production with nearly 80% of global EV battery cell production.[47] As a consequence, in Sweden for example, the bonus for the purchase of an EV was removed in 2022, considering that they offered a sufficiently competitive alternative to ICE vehicles. In Germany, the EV subsidy for individuals was abruptly phased out in December 2023 after the constitutional ruling blocking the reallocation of about €60 billion from the COVID-19 recovery borrowings to the Climate Fund and has not been reintroduced since. More strikingly, the Italian government decided not to renew its eco-bonus for the purchase of an EV in 2025 with the justification that it should instead support national industry with direct subsidies. There are nevertheless clear signs that these subsidies still impact the purchase of EVs: the end of the subsidy in Germany led to a drop of nearly 37% in EV sales in July 2024 compared to 2023.

The support for thermal renovation of buildings is relatively more recent and closely related to the development of regulation on energy efficiency. In the EU, the issue of energy efficiency was initially tackled mainly through regulation imposed to businesses (especially in the power sector). The 2006 Directive on energy end-use efficiency and energy services sets an indicative objective of reducing energy consumption by 9% by 2016 and introduces the mechanism of tradeable "white certificates" for energy consumption reduction. This mechanism and related energy efficiency obligations were further developed with the Energy Efficiency Directive in 2012, which introduced energy efficiency obligation schemes (EEOS) for energy distributors or retailers and a binding target of 1.5% energy savings per year until 2020. The EEOS provided an indirect mechanism for supporting energy efficiency by making it compulsory for energy distributors and retailers to acquire these white certificates, either through their own energy conservation actions or through buying them on a market.

More specifically, the development of building energy efficiency regulation, setting higher standards of efficiency, has been accompanied by a series of subsidy programmes across Europe. It is particularly clear in the case of Germany where the adoption of the new Building Energy Act (September 2023) required that heating systems installed in new buildings use at least 65% renewable energy (and *de facto* ban gas and oil boilers). This new regulation was backed by new federal funding for energy-efficient buildings and provides investment grants of up to 70% for replacing old, fossil-fuel-powered heating systems in existing buildings with systems based on renewables. In France, it was the 2020 Finance Law that created "MaPrimeRenov", a new scheme

40 IRENA (2024). Renewable power generation costs in 2023, International Renewable Energy Agency, Abu Dhabi. For a more complete comparison with fossil-fueled alternative see also: NEA/IEA (2020). Projected Costs of Generating Electricity 2020, OECD Publishing, Paris.

41 The French regulator has published in March 2025 a new document (Délibération n°2025-69) that discusses the new regulation proposals of support mechanism over this segment by the industry and energy ministry released in February 2025.

42 See §109 in the Guidelines on State aid for environmental protection and energy 2014-2020 of the European Commission (2014/C 200/01).

43 https://www.businesskorea.co.kr/news/articleView.html?idxno=43896

44 https://carnewschina.com/2024/05/01/new-trade-in-scheme-set-to-boost-chinese-car-market/

45 https://menews247.com/china-extends-vehicle-trade-in-policy-in-2025/

46 IEA (2022). Solar PV Global Supply Chains, IEA, Paris.

47 IEA (2025). Global EV Outlook 2025, IEA, Paris.

merging multiple subsidies (a tax credit for energy efficiency investments and support programme from the French public housing agency). The amount of a subsidy depends on the type of renovation (notably on the carbon content of materials), on the revenues of the household and on the depth of the renovation. The subsidies can go up to 80% of the total expenses; up to 70,000 € for the most deprived households with significant gains in the energy performance of the building. These types of technical requirements are also ways to incentivize demand for green materials (such as green concrete or bio-sourced materials).

The NextGenerationEU programmes also play an important role in supporting these subsidies. In Poland, "My Electricity" and "Clear Air" priority programmes, supported by the National Fund for Environmental Protection and Water Management, form a major part of the recovery and resilience plan funded by the EU, especially to replace coal-powered district heating or individual heating systems and reduce smog in cities. They also support the dynamic development of individual solar PV in Poland, largely responsible for the increase of green electricity in the power mix. In Spain, the PRTR funds subsidize the energetic rehabilitation of buildings for individuals, enabled by the renUEva platform that makes available all European funding opportunities. In Italy, companies can benefit from support through the Transition 5.0 programme, a tax credit that increases with the share of energy consumption reduction in production or processes (with subsidies of up to €50 million). The Italian "superbonus" tax credit of up to 110% for building renovation is probably the most significant support scheme in Europe. This scheme was, however, plagued by frauds, has led to significant inflation in renovation costs[48] and led to a massive overcost (estimated at €219 billion over four years in 2024 against €37 billion initially planned over a 15-year period)[49] but had a likely strong impact on building renovation and on overall national growth.[50]

These subsidy programmes for energy conservation and thermal renovation of buildings, although subject to the same fiscal constraint as any other subsidies in a context of tight fiscal space and high public debt, are less prone to the criticism addressed to other demand support programmes for clean vehicles or renewable energy. This is likely related to the fact that job creation (mostly services) can be more easily localized and brings more direct economic benefits to the country. It is also notable that they are much less developed in Northeast Asian countries; we found no evidence of similar programmes in Japan and South Korea, and only at a provincial level in China.

[48] https://cepr.org/voxeu/columns/impact-superbonus-italian-construction-costs

[49] https://www.reuters.com/world/europe/why-italys-superbonus-blew-hole-state-accounts-2024-04-09/

[50] Codogno, Lorenzo (Jul. 2024). Italy's Superbonus 110%: Messing with demand stimulus and the need to reinvent fiscal policy, LUISS Institution for European Analysis and Policy (Working Paper).

3. GREENING INDUSTRY WHILE INCREASING AUTONOMY AND SECURITY

KEY TAKEAWAYS

The change in paradigm for industrial policy has led to changes and the emergence of new policy instruments that aim to develop new manufacturing capacities in evolving value chains, with a strong focus on the energy transition. They also aim at decarbonizing existing industrial production, especially targeting energy-intensive sectors.

Some traditional private demand support schemes have evolved to include more aggressive protectionist measures (especially in the US) through local content requirements for public subsidies and public procurement.

New industrial policies are supporting the creation or expansion of production capacities in specific sectors, and particularly for clean technologies. This "green race" is in part fuelled by Chinese dominance in the manufacturing of these technologies, a position acquired and sustained by an opaque and complex multi-channel system supporting production in China. In the US, the IRA has provided a massive and relatively simple response through uncapped production and investment tax credits for the manufacturing of clean technologies. Such tax credits were also adopted elsewhere (in France, Japan or Italy for instance). In Europe, the bulk of deployment support relies on competitive tenders directed towards "strategic" sectors. These competitive tenders are often partly funded by the NextGenerationEU fund or, in certain cases, directly at EU level with the Innovation Fund. These competitive processes have strong underlying economic efficiency and risk of capture justifications but are currently debated due to the risk of failure for bidding companies and their ability to unlock needed transformations along entire value chains.

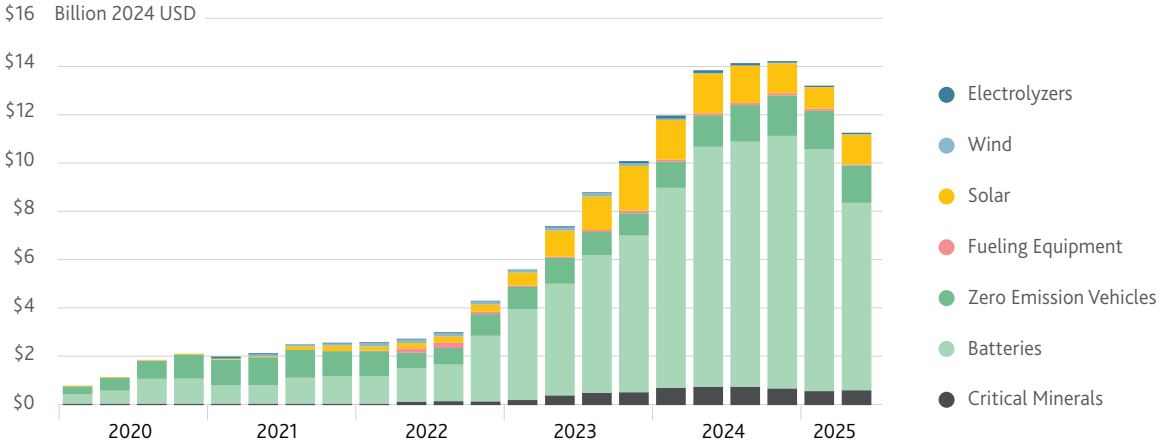
At the edge of industrial and environmental policy, new support schemes are also being deployed, particularly in Europe, to support the decarbonization of industrial plants. These schemes aim for compensating the additional cost imposed on industries by a more ambitious carbon pricing mechanism in the EU than elsewhere. They may also provide a first-mover advantage for the development of new technologies, required for the transition to net-zero. Non-European countries also provide some form of support for the decarbonization of heavy industries (Japan for example aims to develop CCS and industrial heat technologies relying on hydrogen and its derivatives, while China has ambitious targets for the development of electric arc furnaces) but they remain at the edge of industrial strategy. Decarbonization is at the core of European industrial strategy, with schemes such as the German carbon contracts for difference or many competitive grants provided by national funds.

Some countries respond to this last issue with new local content requirements (LCR). These may be clearly expressed, as with the renewed clean vehicle tax credit in the US imposing conditions on the content of battery minerals or the assembly of vehicles in North America, or they may indirectly favour national production—for example, the eco-score in France favouring cars and batteries manufactured in Europe or new technical requirements for the clean vehicle tax credit in the RoK.

Public procurement may also be subject to similar LCRs. The US expanded the requirements for national production with the "Buy America, Build America" condition in the Bipartisan Infrastructure Law. China has also recently adopted regulatory measures favouring national production. In the EU, the Net-Zero Industry Act opens up the possibility to a limited incentive for favoring European products when a foreign third country is dominant in a market. In parallel, there are increasingly more regulations incentivizing strategic green public procurement.[51] Nonetheless, the connection between green public procurement and industrial policy remains relatively loose and there is not a clear political or regulatory platform enabling strategic public procurement directed towards clean technologies in the EU or other countries in our benchmark.

[51] OECD (2024). Harnessing Public Procurement for the Green Transition – good practices in OECD Countries.

Figure 5. Actual Manufacturing Investment by Technology in the US



Source: Rhodium Group/MIT-CEEPR Clean Investment Monitor

3.1. "Green race" *versus* "laissez-faire"

The above-mentioned critique made of transition policies encouraging manufacturing in third countries along with an increased focus on dependencies following the Covid-19 crisis has led to an increased focus on subsidizing clean industries. (**Figures 5** and **6**)

The fast-growing support for green technologies has been motivated by three principal factors:

- green industries are perceived as the future of economic growth and therefore countries seek to develop or maintain their position in these sectors;
- these technologies are required for the green transformation of economic activities;
- there are concerns about the security of global value chains (including a risk of economic coercion), especially in the EU and the US with respect to Chinese dominance of clean technology value chains.[52]

China's dominance in the global and European clean technologies market (electric vehicles, solar panels, batteries) cannot be understated and is also expanding to other sectors including plastic recycling, organic chemistry, pharmaceuticals, and biotechnologies sectors. According to the IEA, China accounts for more than 70% of global electric vehicle production in 2024, with 12.4 million electric cars produced. In contrast, the EU's electric car production stagnated at 2.4 million cars in 2024. China also dominates the solar panel value chain: its share in all manufacturing stages of solar panels exceeds 80% (such as polysilicon, ingots, wafers, cells and modules). The European Commission published in May 2025 a document stating that 94% of the cells and inverters come from China, and 79% of the wafers are also Chinese. China also produces over 75% of batteries sold globally, with giant manufacturers such as CATL and BYD, which have driven battery prices down through their expertise and driven innovation, giving China a competitive advantage. The European Commission also highlights the dependence on China for battery packs, modules and cells (50%), particularly concerning anode active materials (81%). Concerning wind power, China was responsible for almost 60% of wind generation growth in 2023, followed by the European Union at 26%. The European Commission assessed a 93% dependence on China for permanent magnets in wind turbines.

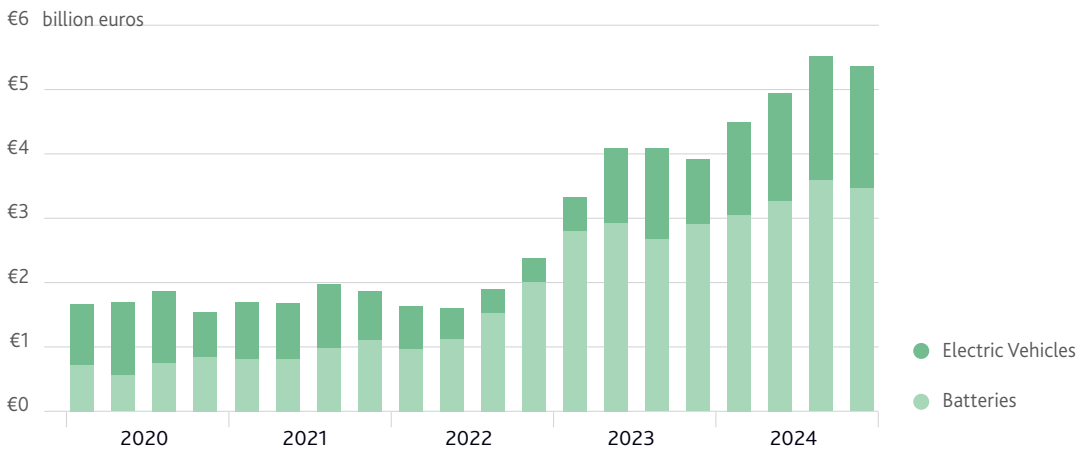
Understanding the roots of Chinese dominance in the clean technology markets is important as the European and American focus on industrial policy was partly built around the argument of existing non-market support mechanisms provided by the Chinese government that favoured Chinese companies.[53] Academic papers show that the multiplicity of instruments (direct subsidies, preferential taxation, below-market credits, equity injections etc.)[54] played a role, as did the significant public support for Chinese companies. The OECD estimates that, on average, Chinese public support for production amounts to 4.5% of the revenues of the Chinese firms covered, from 2005 to

[52] In that respect, it is interesting to read the introduction of the European Green Deal Industrial Plan for the Net-Zero Age, and the section on "Challenges posed by our industrial base" in the German "Industrial policy in changed times". The Speech of the National Security Advisor Jake Sullivan on Renewing American Economic Leadership highlighting the "four fundamental challenges" and the Foreword of the Japanese Basic Policy for the Realization of GX (although it does not directly relate to Chinese competition, but rather highlights the need for secure energy supply) essentially deliver the same analysis.

[53] The Speech of the National Security Advisor Jake Sullivan on 27 April, 2023, on Renewing American Economic Leadership is illustrative in that respect "The People's Republic of China continued to subsidize at a massive scale both traditional industrial sectors, like steel, as well as key industries of the future, like clean energy, digital infrastructure, and advanced biotechnologies".

[54] Chimits, François (Jul. 2023). "What do we know about Chinese industrial subsidies" CEPII Policy Brief No 42.

Figure 6. European manufacturing investment



Source: Bruegel (2025) Clean Tech Tracker, accessed 22/10/25.

2019, with 0.63% from direct subsidies, 0.75% through preferential taxation, 2.35% *via* below-market borrowings and around 0.75% through equity injections (the OECD estimates that tax concessions represent 0.32% of OECD-based firms' revenues and almost none for below-market borrowings).[55] A study by the Kiel Institute for the World Economy shows that in 2022 alone, the EV manufacturer BYD received purchase subsidies amounting to €1.6 billion.[56]

Another important characteristic is the ubiquitous support provided systematically to all economic sectors, an industrial policy that does not necessarily lead to substantive success (for example in semiconductors, pharmaceuticals and commercial aerospace engineering).[57] In effect, one cannot attribute Chinese industrial dominance, in clean technologies in particular, merely to massive subsidy programmes. Our interviews pointed to multiple dynamics, depending on the sector, playing a role in the successful development of green technologies in China. On the one hand, China invested in the development of EVs as early as 2009 with a dedicated strategy, the New Energy Vehicle Programme.[58] This strategy was supported by fierce internal competition and the development of local champions supported by provincial governors, incentivized by provincial target objectives. Industrial concentration and the development of vertically integrated clusters with a very supportive demand subsidies (directly provided to producers until 2022) helped to cut production costs and create more competitive companies. On the other hand, international support mechanisms (the clean development mechanisms notably) helped to support the development of the PV sector. Early technology transfers were integrated into the local economy and internal competition pushed rapid technological development of PV. Finally, a large literature also attributes the success of China to the critical size and know-how accumulated in its industrial ecosystem which gives it a distinct ability to quickly scale industrial production and cross-feed innovations across different industries to decrease production costs.

The US embraced a similar policy for subsidizing industrial production. The IRA, based on direct subsidies and tax breaks, provided a relatively simple but massive incentive to develop manufacturing capacity for clean technologies. This response was in part due to the impossibility of reaching a political consensus, at the federal level, to establish a carbon pricing mechanism. The US therefore had to find alternative ways for achieving the environmental objective, while also encouraging national reindustrialization. The package offers many different (uncapped) tax incentives and funding opportunities but relies on two main instruments: tax credits directly related to the production of goods or services (clean hydrogen, nuclear power production, clean energy technology components, clean electricity production, carbon capture and sequestration or direct air capture) and investment tax credits. This package aimed at incentivizing supply was accompanied by massive infrastructure investments enabled by the Bipartisan Infrastructure Law (a USD $1.2 trillion investment programme adopted in November 2021 for repairing and modernizing the US infrastructure) that facilitated the installation of EV infrastructure and created demand for batteries, flexible grids and transport and storage of green hydrogen. After two years of the IRA, the Clean Investment Monitor estimated investment in manufacturing clean energy and transportation technology at USD $89 billion (from Q3

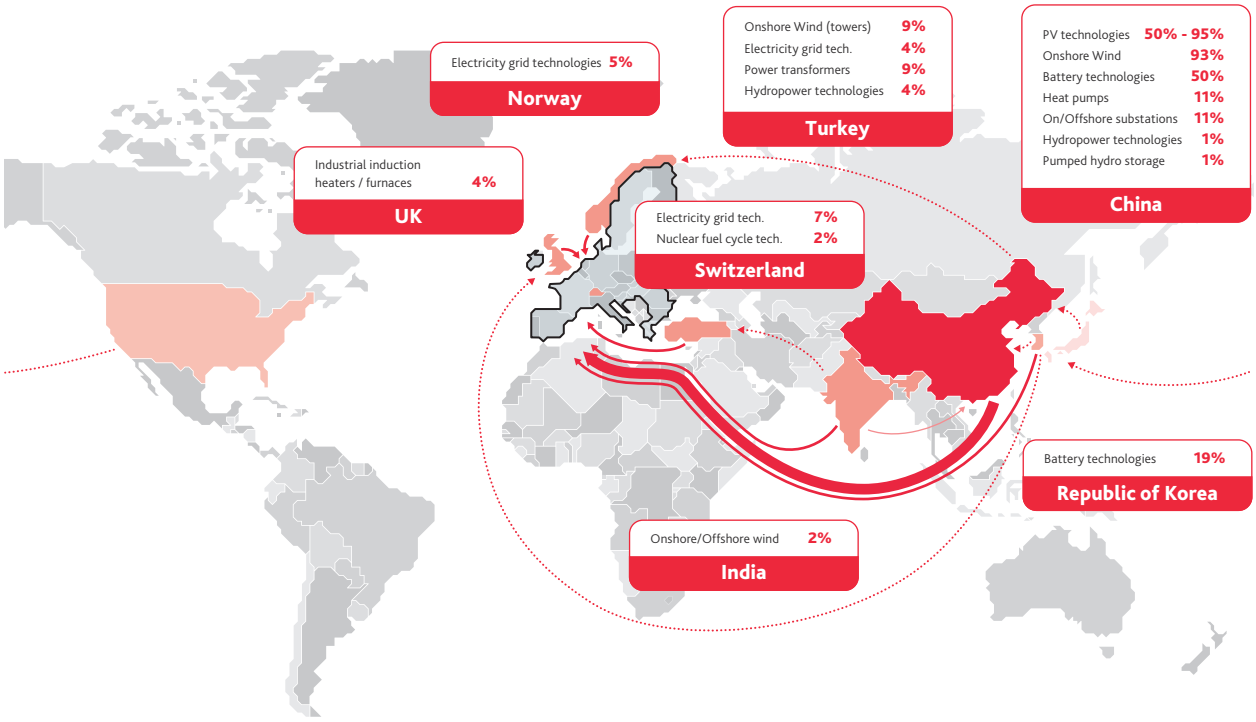
[55] OECD (2023). "Government support in industrial sectors: A synthesis report". *OECD Trade Policy Papers*, No. 270.

[56] Bickenbach, Frank, Dirk Dohse, Rolf J. Langhammer, and Wan-Hsin Liu (Apr. 2024). "Foul Play? On the Scale and Scope of Industrial Subsidies in China" KIEL Policy Brief, No. 173.

[57] García-Herrero, A. and R. Schindowski (2024). 'Unpacking China's industrial policy and its implications for Europe', Working Paper 11/2024, Bruegel.

[58] PRTM Management Consultants, Inc. (Apr 2011). "The China New Energy Vehicles Program – Challenges and Opportunities". World Bank.

Figure 7. Shares of the European Union supply of final products



Source: European commission (2025), Communication on the shares of the European Union supply of final products and their main specific components originating in different third countries under NZIA, accessed 13/06/25.

2022 to Q2 2024), four times the USD $22 billion invested in the two years prior to IRA's enactment.[59] Actual business and consumer investment totaled USD $493 billion, a 71% increase from the two-year period preceding the legislation.

The European Union shared similar concerns about Chinese dominance over future-oriented industrial sectors (e.g. electric vehicles, batteries). The massive fiscal stimulus in the US was in addition perceived as a new threat to a European industrial competitiveness, already severely affected by soaring inflation (especially in energy prices) following Ukraine's large-scale invasion by Russia. The Green Deal provided an additional rationale to develop more ambitious investments in infrastructure and the rollout of clean technologies. But contrary to its big competitors, the EU does not have the fiscal space, nor the legal competence, to massively subsidize its key industries. As a consequence, the EU, guided by multiple industrial strategy papers, relied on less direct tools to coordinate its strategy and facilitate initiatives taken by Member States, especially on the definition of economic incentives for industries. It organized an incremental reorientation of the post-covid recovery plan (NextGenerationEU) and an acceleration of its energy transition with the REPowerEU strategy in 2022, following the energy price inflation crisis. To facilitate Member States' initiatives, the UE undertook several revisions of its competition policy, adopting a short-term (by 2026) relaxation of rules on state aid approval with the adoption of the Green Deal General Block Exemption Regulation (GBER) in March 2023. The renewal of the rules on important projects of common European interest (IPCEI) frameworks in November 2021 also enabled the multiplication of multi-country large industrial projects supporting key sectors (like hydrogen, batteries or semiconductors). Finally, the EU also directed its action through legislation with the adoption of new industrial policy objectives on the reduction of material dependencies (Critical Raw Material Act in May 2024) and the acceleration of clean technologies manufacturing (Net-Zero Industry Act in June 2024). (**Figure 7**)

In the absence of a strong European fiscal stimulus, and due to the nature of NextGenerationEU recovery plans (directly managed by Member States) further supported by relaxed state-aid control, the main response for industrial policy was ultimately organized at the Member State level. As a result, different policies often targeting similar economic activities have been put forward in a fragmented manner, raising the need for a more coordinated approach to industrial policies across the continent.

Italy and Spain, countries benefitting from large endowments from the European Recovery and Resilience Facility

[59] Bermel, Lily *et al.* (Aug. 2024). "Clean Investment Monitor: Tallying the Two-Year Impact of the Inflation Reduction Act" Rhodium Group & MIT CEEPRT.

(respectively €194.4 and €163 billion), mobilized these funds to support the development of national industry in targeted sectors. In Spain, the "Proyectos estratégicos para la transición industrial" (PERTE) provides funds in the form of grants and repayable loans for innovative projects in 12 strategic sectors (including electric vehicles, renewable energy, industrial decarbonization etc.)[60] selected generally through competitive tenders. These competitive tenders are a mandatory feature for state aid policies in the EU but are also seen as a limitation for this type of subsidy; our interviews notably highlight that the administrative burdens even after the selection of projects generate significant lead times in the implementation of projects, leading to foregone opportunities. In Italy, the RRF was largely mobilized for i) supporting the robotization and digitalization of existing industries (with initiatives such as the Transition 4.0 and Transition 5.0 programmes) and ii) regional development in the Mezzogornio and South regions with "development contracts" (for investment above €20 million) and "mini-development contracts" (for investments above €4 million in strategic technologies such as clean and resource-efficient technologies), *ad hoc* subsidies and public support granted by the public agency Invitalia for industrial investments in interior regions. In both countries, as well as in Poland (granted with €59.8 billion from the RRF), the recovery plans were also a major driver of investments in clean technology, energy and transport infrastructure, which are also opportunities for local industrial development.

Despite benefiting from a lower share of the NextGenerationEU Fund due to the attribution criterion, countries like France, Germany, and Sweden have also developed their own industrial policy initiatives using national funds to build future-proof industries, with a particular focus on key strategic sectorsThe Green Industry Law in France (October 2023) introduced a "green industrial investment tax credit" (C3IV), mirroring tax credits implemented in the US, of 20 to 45% of any investment in productive CAPEX and R&D&I for the production of batteries, battery components, solar panels, heat pumps and wind energy production. This solution was also discussed in Germany with a potential introduction of a tax incentive for investments in climate protection (KlimaInvPG) in the Growth Opportunities Act (March 2024) but was finally discarded. The Climate and Transformation Fund (KTF) was the main instrument for supporting German industries, by supporting several industrial transition programmes such as the decarbonization of industry or the H2Global initiative[61], relieving industrial actors from the renewable energy source (EEG) levy and from the increase in wholesale market prices while slightly improving their electrification incentive and. Sweden also mobilized dedicated funds through the "Industrial Leap" (*Industriklivet*) and "Climate Leap" (*Klimatklivet*) funds (with an annual budget of respectively SEK 1.5 billion and SEK 5 billion) for financing industrial projects or feasibility studies selected through competitive tenders.

In Poland, the Recovery and Resilience Fund has been used to equip a "Modernization Fund", part of a wider National Fund for Environmental Protection and Water Management, which supports investments by companies in RES, energy efficiency, storage and the modernization of energy networks. However, these subsidies contribute more to decarbonizing and reducing exposure to the volatility of fossil energy prices than to directly supporting the building of new manufacturing capacities.

3.2. New forms of public support for decarbonizing existing industrial production

Support for decarbonization of industrial sectors is increasingly used. It aims at compensating for the competitiveness losses related to the internalization of the social carbon cost. Indeed, the existence of a carbon pricing mechanism in the EU provides an actual economic incentive for decarbonization, but the cost of GHG emissions is not necessarily (or not as much) internalized by non-European companies.

All European countries in our study, with the exception of Poland, have developed dedicated support mechanisms for the decarbonization of industries. They also aim at reducing energy use and exposure to the volatility of non-renewable resources prices by fostering energy efficiency and electrification. In Italy and Spain, resilience and recovery packages were opportunities to fund the development of competitive tenders for decarbonization projects: "PERTE *de descarbonización industrial*" in Spain or measures for heavy-industry provided by Invitalia in Italy. Similarly in France, multiple competitive tenders were launched as part of the France 2030 plan.[62] The Swedish Industrial Leap programme proposes similar funding opportunities and has been key in the financing of advanced decarbonization projects such as Hybrit, a major European project for producing green steel.

These tenders and subsidy programmes rely in certain cases on prior environmental planning for defining the key decarbonation projects and building the required industrial ecosystem (for example, ensuring offtake demand, pipes and storage capacities with the creation of green hydrogen production facilities). As an example, the French government has highlighted, after an analysis of industrial emissions, 50 plants in France representing 55% of the sector's emissions. Companies were incentivized to propose decarbonization plan for these 50 industrial sites. Fossil Free Sweden has also been a key forum for enabling the definition of sectoral roadmaps for decarbonization. In that case, companies were encouraged to present their action plans and identify pain points where public support should step in to facilitate the realization of these roadmaps.

[60] The full list of the 12 PERTEs is available (in Spanish) at: https://planderecuperacion.gob.es/como-acceder-a-los-fondos/pertes [accessed on 9 April, 2025].

[61] This multiannual fund has then been significantly lowered after the November 2023 federal court ruling declaring an integral part of the government's funding unlawful.

[62] Decarb Ind, Decarb Ind+, Decarb Ind25.

Industrial decarbonization has also received attention and is supported in non-European countries. For example, in the US the "Advanced Industrial Facilities Deployment Program" is a USD $5.8 billion programme operated by the Office of Clean Energy Demonstration investing in projects aimed at emission reduction (including retrofit facilities) from energy intensive industries (iron, steel, concrete, glass, pulp, paper, ceramics and chemical production). The Advanced Energy Project Credit extends the 30% investment tax credit to clean energy projects that reduce their GHG emissions by at least 20%. Similarly, in Japan the new tax credit of up to 40% introduced by the 2024 Tax Reform Act provides support for investments in areas involving green transformation related to green steel and chemicals.

In East Asia, industrial decarbonization is mostly carried out through energy efficiency improvement subsidies aimed at reducing the energy consumption and the carbon intensity of production. For instance, in China the energy conservation and emission reduction plans define decarbonization targets at the sub-industry level (power sector, metals, refining and petrochemical, construction and transport) and provide support to companies taking measures consistent with these objectives through tax breaks, subsidies and green credits or loans.[63] Decarbonization also serves to support the development of new strategic technologies (particularly CCS or hydrogen technologies). For example, CCS and hydrogen (and its derivatives) are part of the strategic technologies supported in the Japan GX policy and embedded in the national decarbonization strategies.[64] The development of carbon markets in Asia is likely to accelerate this dynamic towards decarbonization.

3.3. Market creation policies

Market creation policies can develop demand for a product under criteria that can relate to the environmental, socioeconomic, security or location of the value chain. As shown in Section 2.2.3, environmental policies have historically aimed to address the first challenge. However, due to decreasing production costs and growing attention to the provenance of technologies and dependencies, demand support schemes have been evolving towards more stringent environmental criteria, considering notably the environmental footprint of products with initiatives in materials and products, the mobilization, and the location of production and associated jobs. In this respect, two main solutions are increasingly considered and used as part of new industrial policies: streamlining local content requirements in incentives and an increased mobilization of procurement obligations especially for the public sector, including both green and local content requirements. Mandatory incorporation obligations supporting green products and materials are also considered as a tool to leverage private demand.

Local content requirements

Local content requirements are typically inconsistent with the General Agreement on Tariffs and Trade (GATT) enforced by the World Trade Organization (although there are a few exceptions). Consequently, they remain relatively limited. However, the breakdown of the WTO Dispute Settlement Body coupled with multiple unsolved disputes (notably by the US) against China, alleging violations of WTO rules, undermined the effectiveness of these rules. In parallel, the development of industrial policies was in some cases supported by the recent development of local content requirements, favouring national production, as a condition for private demand subsidies. Such local content requirements can be defined either by explicit rules directly favouring local production as a precondition for public subsidies or through more technical rules, indirectly favouring local production.

The US was the first (and to our knowledge the only) country to apply direct local content requirements to condition public subsidies for EV purchase. The IRA continued the clean vehicle tax credit and offered support of up to $7,500 for the purchase of qualified new vehicles, with multiple LCRs on top of income eligibility limits ($150,000 for a single person). A certain percentage of critical minerals in the battery (from 40% in 2024 to 80% in 2026) should be extracted or processed in the US, or a Free Trade Agreement country, or recycled in North America, with a maximum vehicle price ($55,000 and $80,000 for SUVs or vans respectively). The credit is reduced or eliminated if the EV is not assembled in North America or if most battery components are sourced outside of North America. These conditions were heavily criticized by US partners as economic protectionism, to which the Biden administration argued that they were designed to de-risk American value chains against potential Chinese coercion in the provision of critical minerals. Ultimately, these rules could easily be circumvented using similar public support directed towards commercial vehicles.

There are examples of technical requirements indirectly favoring local manufacturing in France which introduced an environmental score as an eligibility criterion for its EV subsidies in January 2024. The overall scheme has been scrapped in December 2024 by reducing the total amount of the subsidy (down from a maximum subsidy of €7,500 before the reform, to €4,000 in 2025) but maintains the environmental score as an eligibility criterium. In practice, the implementation of the environmental score removes all subsidies from electric vehicles produced in China. The French environmental score can be related to a similar approach in the RoK that tends to favour vehicles that are manufactured in the country based on technical requirements. Indeed, in February 2024 the EV subsidy was revised with additional support provided for specific innovative technologies and based on the energy density of batteries. Consequently, the subsidy gap between Hyundai Motor and Tesla vehicles was expected to widen by approximately

[63] Industrial Energy Accelerator (Mar. 2020) "China Energy Saving and Low-Carbon Technologies Cataologue and Financial incentives to promote energy efficiency technologies".

[64] See for example the revised 16 decarbonization strategies published by the METI on December 2024: https://www.meti.go.jp/english/press/2024/1227_001.html [Accessed on 11 April, 2025].

3 million won (about $2,000).[65] The public subsidies were also reduced in the RoK by about 10% from last year to 2025.[66]

Public procurement

Public procurement can be a significant lever for environmental policy. According to a report by the Stockholm Environment Institute, public purchasing represents 15% of EU GDP while public procurement of goods and services contributes to about 15% of global greenhouse gas emissions.[67] It is therefore unsurprising that the OECD found that 35 out of 38 countries had adopted, in 2022, a national green public procurement framework or policy framework.[68] Moreover, public procurement can be used as a lever for supporting national manufacturing. In fact, public procurement is subject to a specific WTO Agreement on Government Procurement (GPA) that was not signed by China and was restrictively scoped by the US (federal grant programmes that cover federated entities—states or municipalities—are not covered by the American GPA agreement). Public procurement may therefore be used in support of local production through public procurement LCRs. However, the framework supporting green public procurement in the countries in our study is not really leveraged (yet) as a tool supporting industrial policy objectives (with the notable exception of the EU Net-Zero Industry Act, which creates an indirect regulatory link between green public procurement and industrial policy). More generally, the use of public procurement as a tool for industrial policy remains limited outside of the US and China.

Local content requirements in public procurement

The US is probably the country that has the clearest local content requirements (LCRs) for public procurement. The Bipartisan Infrastructure Law introduced the "Buy America, Build America" (BABA) condition which reinforces the provisions of the 1933 Buy America Act: federally funded projects must use domestically sourced inputs or make the case for why that is not possible. Projects under the BIL must use 100% of steel and iron produced in the US, as well as meet BABA provisions for manufactured products and non-ferrous construction materials (plastics, polymers, glass etc.). A total of at least 55% of the value of the product (excluding labour) used in a project must be manufactured in the US. Agencies can grant waivers to funding recipients but this requires the firm to make a concrete case for why making the majority of a product in the US is not feasible.

In China, preference for national manufacturing in public procurement is not as explicit. For example, the Global Trade Alert reported in May 2021 on new government procurement restrictions with local content requirements based on the Chinese government's adopted Order 2021/551, releasing «Auditing Guidelines for Government Procurement of Imported Products», but the document has not been publicly released by Beijing.[69] A September 2021 report by the US-China Business Council provides examples of common strategies for favouring local companies such as incentivized joint ventures, certification challenges, or unfair treatment by provincial leaders.[70] Similarly, the European Commission launched its first investigation under the EU International Procurement Instrument in April 2024 against China in relation to the market for medical devices.

Similar local provisions do not exist (or exist to a smaller extent) in the RoK and Japan, for which our interviews have confirmed that the government traditionally complies with World Trade Organization agreements (both countries are part of the WTO Agreement on Government Procurement). Similarly, the EU institutions limit the use of local content requirements (even at the European level) although timid evolutions can be seen in the law: the Net-Zero Industry Act requires for public procurements of net-zero technologies to set minimum mandatory requirements regarding environmental sustainability. It also systematically disadvantages equipment from third-party countries holding more than 50% of EU market share, or with a growing EU market share, by penalizing its cost by an additional 10% of the price. This penalty is however not implemented if the difference in the price between a third-party country and a European alternative exceeds 20%. The Critical Raw Material Act sets a benchmark for strategic raw minerals by 2030, when the EU should be capable of extracting 10% and processing 40% of its annual consumption, while third countries should not account for more than 65% of the EU's annual consumption.

Green public procurement

Conversely, European countries as well as the RoK have adopted more ambitious legislation for supporting "green" public procurement. South Korea has been a pioneer in green public procurement since 2005 with legislation mandating government agencies to buy green products whenever possible. Article 5 of the *Framework Act on Carbon Neutrality and Green Growth for Coping with Climate Crisis* (Sep. 2021)[71] mandates that public institutions should foster green technology and green industries through preferential purchase of green products. The Korea Environmental Industry & Technology Institute (KEITI) is responsible

[65] https://www.chosun.com/english/industry-en/2024/02/06/UJKGXBCCJVFUFKK4LARBZMKWSQ/

[66] https://www.koreaherald.com/article/10382439

[67] Nilsson Lewis, A., Kaaret, K., Torres Morales, E., Piirsalu, E., Axelsson, K. (2023). *Green Public Procurement: a key to decarbonizing construction and road transport in the EU*. Stockholm Environment Institute.

[68] OECD (2024). Harnessing Public Procurement for the Green Transition: Good Practices in OECD Countries, OECD Public Governance Reviews.

[69] https://www.reuters.com/business/aerospace-defense/china-quietly-sets-new-buy-chinese-targets-state-companies-us-sources-2021-08-02/

[70] Schonberg, Alison (Sep. 2021), *Government procurement and Sales to State-Owned Enterprises in China*, US-China Business Council.

[71] An English translation of that legislation is available at: https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=59958&type=part&key=39

for formulating these criteria through the Korean eco-label[72] while Korea's Public Procurement Service designates categories of products that can only be purchased if they meet "Minimum Green Standards". An article in Open Contracting reports that minimum green standards represented less than 1% of goods purchased in 2010 to more than 16% in 2014, a proportion that has plateaued since then.[73] According to our interview, a score for green procurement is then estimated for each public entity and reviewed in a report. There is apparently no formal commitment mechanism with specific targets but a low score is associated with a strong stigma.

In Europe, similar initiatives exist in Italy and Sweden. In Italy, green public procurement has been embraced early with the National Action Plan on Green Public Procurement setting national objectives in 2008. It introduced the Minimum Environmental Criteria (*Criteri Ambientali Minimi* – CAM) in a few sectors that became compulsory for all public procurement in supplies, services and works with the new Public Contracts Code in 2016. The 2023 update in the National Action Plan for Green Public Procurement sets these criteria for 20 product categories and introduced the obligation of a "sustainability report" for all procurements with an evaluation of the socioeconomic, local and global environmental impacts, including a life-cycle analysis of the project. Despite this ambitious framework, a report by the Green Procurement Observatory shows that in 2023 only 52% of municipal contracts implement these CAMs.[74]

The Swedish approach relies on a more flexible and pragmatic approach. The National Public Procurement Strategy (2017) cites "environmentally responsible public procurement" as one of its 7 objectives. However, the proposal of a law, made in October 2021, to require that local authorities consider climate, environmental and other social and labor laws in public procurements was finally rejected by the government in June 2024. The Swedish Procurement Agency rather acts as a facilitator of green public procurement by producing a detailed sustainability criteria database with three different levels (basic, advanced and spearhead level), providing a risk analysis service detailing where the supply chains of different products pose higher social and environmental risks and a life cycle costing tool to calculate the cost of a product or a service over its whole life cycle. An article by the Stockholm Environment Institute reports that the Swedish Procurement Agency estimated that the percentage of total public procurements adopting environmental requirements was 58% in 2020 (down from 63% in 2018).[75]Leveraging a long-existing policy of green public procurement in the EU and increasing attention to non-financial criteria can be a way of fostering industrial policy, as suggested in a recent report by the European Court of Auditors on public procurement in the EU. This report highlights that the share of public contracts awarded in favor of the lowest bidder still accounts for the bulk of all awards in all Member States and encourages a more strategic use of public procurement.[76] The partial "Buy European" provisions scheduled in the White Paper for European Defence and the ReArm Europe Plan/Readiness 2030, motivated by security reasons, are a potential step in that direction while the Clean Industrial Deal communication and subsequent CISAF also open the door for greater consideration of local content requirements in public policies and expenditure.

Emerging regulation favouring green content of products?

The green transition requires the rapid adoption of new technologies and therefore, regulation incentivizing (or imposing) the replacement of older, emission-heavy, alternative technologies. Such regulation may or may not favour the development of locally sourced green products to support domestic production while at the same time limiting GHG emissions in the production process. In the European context, with a relatively more decarbonized energy system and high availability of materials available to be reused and taking into account the environmental impact of transportation, it is often argued that environmental criteria, both circular or based on the carbon footprint, would tend to favour local industry. One example of such regulation is the new European Battery Regulation, adopted in August 2023, which mandates minimum levels of recycled materials (specifically cobalt, lead, lithium, and nickel) in certain battery types from 2031 onwards. Similarly, the Construction Product Regulation, adopted in November 2024, enables the European Commission to set minimum recycled content for construction materials through dedicated delegated acts.[77] More generally, the Ecodesign for Sustainable Products Regulation (ESPR) adopted in May 2024 sets new sustainability requirements (products must meet criteria related to durability, reparability, recyclability, energy and resource efficiency, and the inclusion of recycled content) applicable to all products manufactured in the EU.

[72] Additional information on the Korean ecolabel can be found on KEITI website (also available in English): https://ecosq.or.kr/websquare.do#w2xPath=/cm/main/epd/index_epd.xml

[73] Brown, Sophie & Dongho Han (Sep. 2024). "How South Korean enables its green transition through green public procurement", *Open Contracting Partnership*.

[74] The results were presented at the National Ecoforum for environmental law in 2023 available (with the slides in Italian) at: https://www.appaltiverdi.net/ecoforum-2023-losservatorio-presenta-i-dati-sulle-amministrazioni-comunali-del-vi-rapporto/

[75] Nilsson Lewis, Astrid & Magdalena Machlowska (Jul. 2022). *Decarbonizing the EU's road and construction sectors through green public procurement The case of Sweden and the Netherlands*, Stockholm Environmental Institute.

[76] European Court of Auditors (Dec. 2023). *Public procurement in the EU Less competition for contracts awarded for works, goods and services in the 10 years up to 2021*, Special report 28/2023.

[77] Art. 22 Regulation (EU) 2024/3110 of the European Parliament and of the Council of 27 November 2024 laying down harmonized rules for the marketing of construction products and repealing Regulation (EU) No 305/2011.

Additionally, as highlighted in section 2.3.2, governments increasingly support the development of "green" basic products in heavy industry, such as steel or cement. These products are alternatives to products manufactured with highly emitting processes. However, if GHG prices are not properly internalized, these "green" products suffer from a significant "green" premium with relatively few incentives for consumers to buy low-carbon products. The ongoing large investment programmes for decarbonizing production in heavy industry therefore call for the development of new regulation supporting these initiatives and favoring first-mover advantage through the development of green lead markets.[78] For instance, in February 20025 Japan adopted a change in its clean vehicle subsidy which offers an additional bonus of 50,000 yen (about €300) for clean energy vehicles made of low-carbon-emission steel.[79] Another example worth mentioning is the inclusion of carbon content in new building regulation such as the latest evolution of the regulation in France, the RE2020 regulation, which creates a market for low carbon materials and has helped to support a burgeoning industry of clean cement and material production.

[78] The German Federal Ministry for Economic Affairs and Climate Action released in July 2024 a publication highlighting instruments for creating green markets through public procurement, requirements for the emissions intensity of basic materials and other economic instruments pricing emissions that are not currently covered by EU ETS and CBAM. Federal Ministry for Economic Affairs and Climate Action (Jul. 2024), *Lead markets for climate-friendly basic materials Concept proposed by the Federal Ministry for Economic Affairs and Climate Action.*

[79] https://yieh.com/en/japan-launches-incentives-for-green-steel/153032

4. INDUSTRIAL POLICY INITIATIVES TO SUPPORT TERRITORIES DEPENDENT ON DECLINING ACTIVITIES

KEY TAKEAWAYS

One important motivation for the development of industrial policies (mostly in Western countries) is their employment benefit, although potentially contradictory to the parallel support for advanced, essentially robotized, manufacturing (bringing fewer, highly qualified job opportunities).

Regardless of the narrative, the green transition is affecting employment in certain job-intensive sectors (such as coal mining) and redistributing the comparative advantage of industrial regions, putting at risk highly industrialized economies with lower renewable energy endowments and potentially higher energy costs (e.g. Poland). The relocation of productive factors (across geographies and sectors) calls for just transition policies mitigating the local but potentially important socioeconomic costs of transition.

In the US, this issue is partly addressed by encouraging investments, through additional bonus credits, in deprived areas (the energy communities or brownfield areas). These incentives remain however limited and insufficiently targeted.

In Asian countries, although the social cost of transition might be particularly high, we have identified very few initiatives supporting worker relocation. They might eventually be addressed at the provincial level in China, but the support granted to workers seems disproportionately low compared with support granted for industrial development.

In Europe, just transition policies remain underdeveloped with the limited initiatives only at EU level such as the Just Transition Fund and in some Member States like Spain. A more integrated approach at the European level could help to improve anticipation of sectoral transition, especially in a context of tight public spending constraints, and geographical relocation due to increased industrial specialization across Europe.

Industrial policy has been associated with labour policy on two grounds: on the one hand, there is an academic and political discourse that relates industrial growth with the spread of "good jobs", especially in medium-sizer or small urban areas;[80] on the other hand, sectoral changes within industry require adjusting training and skills and reallocate workers across sectors and geographies. The narrative around just transition appeared long ago and now leads to industrial policy initiatives aiming at mitigating the social costs associated with the reallocation of the workforce in its geographic and sectoral distribution.

4.1. Different positions on just transition: US *versus* East Asia

In the US, industrial policy has been directly related to a so-called "policy of the middle class". This link was particularly evident in Jake Sullivan's speech on "Renewing American Economic Leadership" at the Brookings Institution identifying the fourth fundamental challenge of "inequality and its damage to democracy". Similarly, Brian Deese's "Remarks on Executing a Modern Industrial Strategy" highlight that the federal plan to expand American infrastructure "will focus on place and equity—on *where* and *how* we build—because this helps us to unlock more of our nation's economic potential".

As a consequence, the main blocks of the American industrial policy (the Bipartisan Infrastructure Law, the Inflation Reduction Act and to a lesser extent the CHIPS and Science Act) include provisions related to the inclusion of social and labour conditions. In particular, the BIL-funded infrastructure projects have conditions on the labour and equity standards and are often subject to the Davis-Bacon Act (1931) that establishes minimum wages and fringe benefits, or require project labour agreements (PLAs), community workforce agreements (CWAs) or community benefit plans. The first two instruments are pre-hire collective bargaining agreements negotiated by project owners and workers on wages, benefits and other work conditions. Community Benefit Plans go one step further as they outline how projects may affect marginalized communities and how they will address any adverse impacts. IRA's grants are also often subject to similar conditionalities for grants and subsidies provided to private projects. It also offers additional incentives through "bonus tax credits" that go beyond the base rate for projects that invest in brownfields, retired coal communities or invest in solar or wind in low-income communities. These different bonuses cumulate such that base and bonus tax credits can cover up to 70% of a project's costs. However, our interviews highlight that the practical implementation of these social criteria was often unclear or used for secondary objectives: for example,

[80] E. Macron speech for "Accelerating [French] Industrial Reconquest" is particularly illustrative in that respect: citing the challenge of deindustrialization at the very beginning of his speech he declares "Industry has a structuring economic and territorial role. It is relatively good jobs, better paid than others. Hence, it pulls the rest of the economy towards good jobs." (Translation by the authors).

the definition of "energy communities" (brownfield sites or fossil fuel communities) was extended in March 2023 to any port in order to further support the offshore wind industry.[81] The size of these additional "social" bonuses (+10% of the initial tax credit for energy communities) is also considered to be insufficient to be a determining factor for private investment.

By contrast, the Asian countries in our study have few instruments to support the just transition, despite major challenges. In China, an industrial restructuring fund was implemented in 2016 for coping with the social impact of a strong state-led concentration policy affecting the coal and steel industry (closing inefficient small plants). The fund was granted with CNY ¥100 billion over 2 years (and has been continued in 2019) to help firms tackle worker resettlement. We found hardly any evidence of concrete actions for this fund. Instead, China publishes a catalogue for guiding industrial restructuring that provides for restructuring industries falling under three categories: "encouraged", "restricted", and "obsolete".[82] However, a 2023 report by the UNDP[83] estimates that based on the current Chinese policy trajectory, 52% of jobs in the coal sector (that is 1.3M jobs) are projected to disappear by 2030. A later 2024 report by the UNDP however reports policies implemented at the provincial level but also advocates for a more structural approach (especially regarding large state-owned companies) for tackling just transition in China.[84]

The RoK and Japan also face significant challenges without a clear framework for responding to the issue of just transition. In Korea, the focus is rather on the development of digital skills (e.g. through the "Comprehensive Strategy for Digital Workforce Development" in September 2022). While the Basic Policy for GX in Japan states that "Just Transition will be backed up by acquisition of new skills and smooth transition of the labour market to green and other emerging industries"), our interviews confirmed that the Japanese government had no particular initiative in that direction so far.[85]

4.2. Just transition in Europe: an under-invested debate

The European Union has created a new Just Transition Fund in the context of the European Green Deal as a new instrument of Cohesion Policy in the 2021-2027 long-term EU budget and was equipped with €19.3 billion for the period. It aims at supporting the regions most affected by the transition towards climate neutrality focusing on coal-dependent regions. This is a significant contribution for just transition, primarily directed towards Central and Eastern Europe that are major coal producers (Poland is the primary beneficiary with €3.8 billion allocated, before Germany with €2.5 billion).

However, this European initiative has been matched by limited complementary actions or strategies at Member State level, with the notable exception of Spain (see below). The functioning of the JTF implies the definition of action plans, the just transition plans, which intend to conceive a consistent action for regions that will likely be hit by the transition towards climate neutrality. In Poland, just transition plans were defined for five regions,[86] mostly investing in energy infrastructure and the diversification of economic activity. Similar just transition plans were defined for the regions of Taranto and Sulcis Iglesiente, worth about €1 billion, with about a third of these funds directed towards energy, another third for economic diversification and the last third to mitigate economic and employment effects of the transition.

Member States have rather developed *ad hoc* programmes or policies directed towards skills and job transition (representing significant change in the labour legislation). In France, the call for proposals "Skills and Future Jobs", equipped with €700M as part of the France 2030 plan, helps to fund projects and establish skill diagnoses related to the ten priority sectors. Italy proposes a "Training 4.0 tax credit", part of its Transition 4.0 plan, that provides a tax credit to companies investing in training on new skills for their employees.[87] In Germany, the *Act to Strengthen the Promotion of Initial and Further Training* (Jul. 2023) has introduced the new "*Skills Development Benefit*" for companies paid as a compensation benefit for employees whose jobs are threatened by structural change, but for whom continuing education can enable future-proof employment in the same company. Sweden has conducted a profound reform of its labour legislation with the reform of the Swedish Employment Protection Act (March 2022) that enabled a collective agreement with Swedish unions leading to the creation of a new "*Transitional Study Grant*" of up to €3,822 per month for job-to-job transitions and lifelong learning for employees.

Nonetheless, these different initiatives lack a sufficient forward-looking vision of other sectors that will be impacted

[81] https://www.projectfinance.law/publications/2024/march/more-areas-qualify-as-energy-communities/

[82] China's NDRC announced a 2024 Catalogue for Guiding Industry Restructuring marking a strategic shift by focusing on high-tech and green industries. See China Briefing article on China's 2024 Catalogue for Guiding Industry Restructuring: https://www.china-briefing.com/news/chinas-2024-catalogue-for-guiding-industry-restructuring/

[83] UNDP (Jun. 2023). *Navigating the Path to a Just Transition: Employment Implications of China's Green Transition.*

[84] UNDP (Nov. 2024) *Towards a Just Transition: How Greening China's Economy Will Impact its Regions.*

[85] A 2022 report by the British Academy also stresses that "Japan has only explicitly engaged with just transitions thinking to a limited extent" but highlight a few local initiatives. Mabon, Leslie, Andrew Chapman, Benjamin McLellan, Yi-Chen Huang (Jun. 2022). *Just Transitions in Japan*, The British Academy, Just Transitions to Decarbonization in the Asia-Pacific.

[86] Silesia, Małopolska, Wielkopolska, Lower Silesia and Łódzki.

[87] 70% for eligible expenses for SMEs up to €300 k, 50% for medium-sized and 30% for large companies (up to €250 k). The list of topics for the training is however quite restricted, and focused on digital transition (big data and data analysis, cloud computing, cyber security, IoT etc.).

by the green transition such as the automotive and refinery and chemical sectors. In addition, the green transition is likely to impact the geographic distribution of industries within Europe with relative changes due to comparative advantages which will certainly lead to increased distributional impacts across Member States. As an example, the success of the Iberian Peninsula projects in the first round of the Hydrogen Bank auction (80% of the total awarded volume is directed towards Spain and Portugal) and of the Nordic countries shows a clear competitive advantage of these regions over Central and Eastern Europe. It is probably the right economic decision and goes in favour of higher regional specialization based on geographic endowments, human capital and other local assets available in different European regions.[88] However, although Germany may have enough fiscal space to complement the European auction with a national auction (although the plan was finally abandoned), this is not necessarily the case in other highly industrialized countries such as Poland or Czechia. A significant deindustrialization movement in Central and Eastern Europe triggered by green transition could threaten their economic catch-up and trigger social and political unrest. The unionization of industrial policy therefore calls for a much deeper and more integrated reflection on just transition policies.

[88] McWilliman & Zachmann (2023) argued in an article that European industrial policy should probably be "smarter" focusing on regional competitive advantage. They propose to develop bottom-up modelization and empirical methods to identify regions' unique comparative advantage and draw "maps of least resistance" that estimate the ability of region to diversify into a desirable green technology. McWiliams, Ben and Georg Zachmann "Smart green industrial policy" in Tagliapietra, Simone, Reinhilde Veugelers *et al.* (Jul. 2023). *Sparking Europe's new industrial revolution: A policy for net zero, growth and resilience*, Bruegel.

5. DE-RISKING AND COMPETITION FOR RESOURCES

KEY TAKEAWAYS

In a context of deep rivalry between China and the US, the Biden administration has largely continued and expanded the de-risking strategy initiated under the Trump administration. It took the form of more targeted trade defense instruments (additional tariffs on strategic items such as clean technologies), also aiming at slowing down the technological development of China (export controls for semiconductors, foreign investment controls). However, the Biden administration also innovated by using the tools of industrial policy to promote the decoupling of global value chains from Chinese influence. This took the form of conditional subsidies, imposing "friend-shoring" for the clean vehicle tax credit or completely prohibiting investments in "foreign countries of concern" in the case of the CHIPS and Science Act.

Japan and the Republic of Korea adjusted their trade policy to this intensified rivalry, navigating between their dependence on Chinese imports for strategic industries and deeper alignment with the American agenda for national security reasons. This translated into a "balanced" approach, favouring stockpiling over decoupling, and the development of regional alliances with ASEAN countries, Central Asia and even with other continents (e.g. Africa in the case of the RoK).

China has continued, with the Belt & Road Initiative, a policy of South-South cooperation but also reacted to the challenges posed by increased western competition, for example by expanding foreign investments in mining operations and imposing export restrictions on critical materials. New barriers to trade however pose a significant challenge for the export-oriented Chinese manufacturing system, which needs to find foreign markets for the oversupply of its production capacities.

The EU is walking a tightrope, trying to avoid decoupling from China while securing particularly strategic supply chains and deterring economic coercion. It adopted new legal instruments to strengthen its means against economic coercion and unfair third-country competition. Additionally, the EU aims at securing steady energy provision, with the diversification of its suppliers, and of critical minerals by adopting a "mineral diplomacy" complemented by the new Critical Raw Materials Act. Nonetheless, although some countries like Germany try to develop new value chains with the Global South for the provision of green energy products (hydrogen), the EU has not yet taken steps to develop a strategic framework supporting its renewed industrial ambition with new and diversified international value chains, similar to the Chinese Belt and Road Initiative.

Industrial policy is not only viewed as a tool for defending infant-industries or protecting sunrise sectors. In the context of global tensions, industrial policies also appear to be a new way to diversify and de-risk international supply chains, which might be subject to economic coercion. The different national policy initiatives due to their impact on several value chains that might clash on international markets could also raise tensions between blocs, contributing to the recent increase in trade disputes and calling for a significant effort in economic diplomacy fully integrating the environmental transition challenges.

5.1. Impacts of the very defensive US approach

In the context of heated rivalry with China, the US has structured its industrial policy during the Biden administration in order to steadily decouple from Chinese supply chains. Our interviews highlight the strong consistency of the American policy, at least since the Trump administration: none of the tariffs imposed before Biden's election were removed after he took office, and were eventually expanded. Restrictions were applied to outbound investment in China[89] and additional tariffs have been imposed on solar PV[90] and other green technologies.[91] Export controls over dual-use items (especially semiconductors and chips) were greatly expanded.[92]

89 Executive Order on Addressing United States Investments in Certain National Security Technologies and Products in Countries of Concern (9 August, 2023).

90 Fact Sheet: Biden-Harris Administration Takes Action to Strengthen American Solar Manufacturing and Protect Manufacturers and Workers from China's Unfair Trade Practices (16 May, 2024).

91 Fact Sheet: President Biden Takes Action to Protect American Workers and Businesses from China's Unfair Trade Practice (14 May, 2024).

92 Commerce Control List Additions and Revisions; Implementation of Controls on Advanced Technologies Consistent with Controls Implemented by International Partners A rule by the Industry and Security Bureau (9 June, 2024)

Moreover, the Biden administration has diversified the tools used for limiting Chinese influence in American supply chains through its industrial policy. This was the case with the IRA by imposing conditions on the clean vehicle tax credits: gradually increasing share of batteries' components (from 40% in 2024 to 80% in 2026) in an electric vehicle had to be extracted or processed in the US or a Free Trade Agreement partner country, the vehicle had to be partly assembled in North America, as did the majority of battery components. These measures were obviously perceived as a form of protectionism by allied countries (and more specifically the EU), but the Biden administration always rather stressed the importance of limiting Chinese influence over these value chains (for example in Jake Sullivan's speech on "Renewing American Economic Leadership"). Although both objectives were probably sought, the relatively constructive approach of the Biden administration during the US-EU Trade & Technology Council (and the loophole in the IRA clean vehicle tax credit for commercial vehicles) suggests that the primary objective could have been decoupling from Chinese value chains. The CHIPS and Science Act had much stricter and targeted conditions: any company receiving federal subsidies had to limit its operational expansion in "foreign countries of concern" (at the forefront of which China) for the next 10 years.

It is unclear to what extent these incentives and prohibitions may impact global value chains in the long term; the historical perspective is still limited.[93] However, this has had an impact on clearer alignment of the RoK and Japan with the US, with a political will to de-risk their own value chains from China. Japan has signed with the US a Critical Minerals Agreement on 28 March 2023 to ensure free trade in critical minerals. This enabled Japan to be the only country to be considered as a country with a "restricted" free trade agreement and therefore qualifying for the Battery Components Requirement in the Clean Vehicle Credits for Japanese electric vehicles manufactured in North America (this interpretation of a FTA was criticized by the American Congress itself).[94] Similarly, the RoK released a "Strategy for a Free, Peaceful and Prosperous Indo-Pacific Region" in December 2022 naming the US as an "ally" alongside with Japan and Australia in the Pacific region, while China was designated as a "key partner for achieving prosperity".

Indeed, the economic relations are deeply entrenched between the RoK (or Japan) and China and decoupling from Chinese value chains is a challenge of a different nature: about 90% of the supply of critical minerals for key industries in the Korean EV, battery and semiconductor sectors relies on Chinese imports.[95] To respond to this challenge the RoK has developed a critical mineral strategy (February 2023) that provides instruments notably for stockpiling of certain critical minerals and engaged in active raw material diplomacy to de-risk, diversify and secure it supply chains with Southeast Asian countries, notably through the ASEAN-Korean Collaborative Initiative, or Central Asian republics with the K-Silk Road Initiative.

The international tensions and the American containment policy against China have obviously affected Chinese trade relations. China has however developed a stable and long-term international cooperation policy with the Belt and Road Initiative. It has adapted this policy by "greening" its infrastructure investments: the "Opinions on Jointly Promoting Green Development of the Belt and Road" (April 2022) announced that China will no longer finance coal-fired power plants and will rather foster green energy, transportation and industry. According to our interviews, this change partly reflects the need to export the growing overcapacity of Chinese manufacturing of green technologies (and especially solar PV). However, it is also interesting to note that the global competition for critical minerals seems to affect Chinese investment decisions: although mining investments represented previously a relatively small share of Chinese investments under the BRI,[96] investments in metals and mining have jumped by 158% in 2023 (reaching almost $20 billion) compared with 2022.[97] This denotes a clear acceleration of minerals and metals investment focused on the green energy transition (investments are primarily directed towards copper, lithium and nickel, mostly in Africa).

5.2. European Union: in search of a balanced "de-risking"

In a tense international scene, the EU has adopted a more balanced approach than the US, focusing on de-risking its value chains while not cutting its trade relations with China. This balanced policy was embodied by the Critical Raw Mineral Act (May 2024) that sets benchmarks to be reached by 2030 for the strategic raw materials.[98] New tools such as a joint purchasing

93 Attinasi, Boeckelmann & Meunier (2023) model the spillover effect of the IRA on production of different goods (electrical and optical equipment) and estimate a significant relocation effect with an increase of US production by 6% to 30% while China would lose -1% to -5% and the EU between -0.5% and -3%. Grazia Attinasi Maria, Lukas Boeckelmann & Baptiste Meunier (3 July, 2023). "Unfriendly friends: Trade and relocation effects of the US Inflation Reduction Act", *VoxEU column.*

94 Congressional Research Service, "U.S.-Japan Critical Minerals Agreement" Updated 8 January, 2025.

95 Bowen, James (Jan. 2024). *The Raw Materials of Economic Security: South Korea's Evolving Energy and Critical Minerals Policies in an Era of Disruption*, Korea Policy 2023

96 China's M&A activity in the Belt and Road Initiative (BRI) countries for mining & metals over the 2005-2016 period is estimated at $6.6 billion, against $38.6 billion for oil & gas. See Farooki, Masuma (Mar. 2018). "China's Mineral Sector and the Belt & Road Initiative" *European Policy Brief Strategic Dialogue on Sustainable Raw Materials for Europe* (STRADE) No. 2/ 2018.

97 Nedopil, Christoph (Feb 2024). China Belt and Road Initiative (BRI) Investment Report 2023, Griffith Asia Institute.

98 The CRMA sets a benchmark (art. 5) to reach, by 2030: 10% of EU annual consumption from EU's extraction capacity, Union processing capacity of at least 40% of annual consumption; Union's recycling capacity of at least 25% of the Union's annual consumption of SRMs. For diversification, by 2030 the EU should ensure that no third country account for more than 65% of the EU's annual consumption of such SRM.

mechanism aim to aggregate European demand to provide more bargaining power to European companies while Member States are responsible for ensuring their resilience against supply disruption with the implementation of regular stress tests. Strategic projects should facilitate the development of a European supply of critical minerals.

While the CRMA should enable better resilience of supply chains, the EU has recently developed an array of new legislative weapons against coercion. The European Anti-Coercion Instrument was adopted in December 2023 and offers a wide range of calibrated responses. The Foreign Direct Investment Screening Regulation has applied since October 2020 and has harmonized the rules for FDI screening in the EU with the creation of a cooperation mechanism between the European Commission and Member States. The International Procurement Instrument applicable since August 2022 enable the Commission to promote reciprocity in access to international public procurement markets while the Regulation on Foreign Subsidies (July 2023) enables the EC to address distortions caused by foreign subsidies. These tools have been used by the Commission, especially the Regulation on Foreign Subsidies on the grounds of which were imposed countervailing duties of up to 35.3% against Chinese electric vehicles in early October 2024. Additional investigations into the Chinese wind turbine and solar manufacturing industries are ongoing.

In addition to this new arsenal of tools against economic coercion, the EU has engaged in active "Raw material diplomacy". It has established partnerships and strategic dialogues on raw materials through memoranda of understanding signed with resource-rich countries. This diplomacy is conducted in partnership with the US through the *Mineral Security Partnership* (which also includes individual EU Member States). More generally, new initiatives were launched to secure access to energy supply, especially liquefied natural gas, in the context of decoupling from Russian gas. These initiatives extended to the "future of energy" supply such as the Mediterranean Green Hydrogen Partnership that intends to accelerate imports from Southern Mediterranean countries. Egypt and Morocco have already signed bilateral green hydrogen partnerships.

Although only the EU is competent for trade policy, some Member States have developed bilateral agreements and relationships, especially to diversify supply of critical minerals and energy. This is particularly the case for Germany, which has signed bilateral raw materials partnerships with Mongolia, Kazakhstan and Peru and joint declarations with Chile, Australia and Canada. Germany has also developed tools for international cooperation for securing its supply in minerals and energy carriers. The KfW Development Bank has recently opened a new raw materials fund (October 2024) valued at €1 billion, valid until 2028. Co-funding will be provided to domestic and international projects focused on mining, processing, or recycling of raw materials that the EU has classified as strategic in the CRMA. Its H2Global programme was an international auction aiming at securing the provision of green hydrogen produced by partner countries.[99] Italy has also announced an ambitious international partnership policy with its *Mattei Pla*n presented at the Africa-Italy summit in January 2024. This initiative announced €5.5 billion in grants, credits or guarantees for building a new form of partnership with African countries. The practical implementation of this plan remains to be defined but the 21 projects in progress as of December 2024 were not directly related to mineral or energy needs (and were rather distinct from industrial needs).

Overall, the European approach reflects both its commitment to free trade and its exposure to economic coercion, with limited energy or mineral natural resources. This position will probably be a difficult line to hold if the reinforcement of American tariffs against China leads to a massive relocation of Chinese over-supply in green technologies towards the EU, weakening the development of European industry. However, maintaining a constructive approach with China, driving green technologies price down and building on Chinese technological superiority in certain sectors (solar PV, EVs) could accelerate the green transition. This trade policy should not underinvest in creating new international value chains. Reinforcing trade partnerships with the Global South by leveraging its renewable resource potential while diversifying supply chains and improving economic development, which may ultimately create external demand for green technologies, is a resilient, fair and efficient way of developing a high-value-added European green industry.

[99] The first contract to import green ammonia from Egypt was signed in July 2024. A new joint auction of Germany and the Netherlands worth €2.5 billion was announced in February 2025.

CONCLUSION: LESSONS FOR THE EU INDUSTRIAL POLICY AGENDA

With many countries turning to more active industrial policies, defining its own will likely remain an important challenge for the EU in the coming years to fulfil its core objectives. Based on the review of country approaches, this report identifies 7 lessons for the EU going forward.

A first important learning is the importance of **long-term commitment** and clarity on the objectives of industrial policies. Industrial policy requires large, long-lasting investments, and inconsistent policymaking can be a major deterrent. The uncertainty surrounding the continuity of the US Inflation Reduction Act (IRA) following the change in administration in the United States of America illustrates this risk. In contrast, China's clear commitment to decarbonization and certain segments of its industries has enabled market forces to drive down costs and foster innovation. Maintaining competition between countries and companies with high-level guidance on objectives, such as the net-zero commitment, can be a way forward. The fierce competition between provinces in China and states in the US (e.g., California setting standards for EVs) can serve as an example for the EU. The EU should thus continue to build upon the objectives of the Green Deal and, in particular, its climate neutrality objective to provide clarity to its economic actors.

Second, in a competitive global environment, the EU can differentiate its industrial policy by focusing on **material efficiency** and the **circular economy**. Outside the EU, the circular economy receives little policy attention. The US has largely ignored it, and Japan lacks a specific plan. By contrast, EU actors are well placed in circular innovation. This provides a unique opportunity for the EU to lead. So far, however, the circular economy has largely been viewed as a standalone policy, primarily associated with waste recycling and reduced material use, its contribution to the EU strategic agenda and explicit integration into industrial strategy have been limited despite most green industry funds being open to circular projects. The EU could develop a more targeted technological roadmap to foster the development of recycling for key materials like batteries and building materials such as concrete and address the social and economic challenges preventing the use of circular products. A more circular approach offers a partial solution to several industrial challenges, as well as to the core EU priorities: it contributes significantly to decarbonization and reduced material use (addressing both GHG emissions and broader environmental issues), it enhances supply security, and has the potential to create jobs in maintenance and repair services, offsetting potential job losses from the automation of manufacturing; it opens new innovation and market opportunities.

Third, a successful industrial policy hinges on **market size**. China and the US have leveraged their large domestic markets to drive down prices and achieve success. Countries like Korea, Japan, Sweden, and Germany have relied on an early focus on exports to reach critical scales to support entire economic segments of their economy. For the EU, internal barriers to the single market constitute a major weakness, as highlighted by the Letta Report. This fragmentation, along with a financial sector less inclined to support risky industrial ventures, can hinder large-scale projects. Overcoming this fragmentation would allow the EU to leverage its market and create demand for new products and services that align with its societal goals. This "lead market" approach can induce transformative change, promote innovative solutions, and bypass the risk of established players capturing policy benefits. By setting ambitious climate and circular criteria, the EU can accelerate its transition and favour EU-manufactured products.

Fourth, there is a need to break down silos for **better industrial governance and planning** in Europe. While progress has been made, more EU-level coordination is needed to capitalize on the EU's market size and enable equitable spatial specialization. This contrasts sharply with the American model, which has minimal central planning and an almost non-existent technological focus, and the Asian model, which is highly top-down and based on predefined technological priorities. The EU finds itself somewhere in between, with targeted support for specific technologies through initiatives like IPCEIs (Important Projects of Common European Interest) and a more technology-agnostic approach via the Innovation Fund. However, at the Member State level, there is a tendency to support "a little bit of everything," despite some countries having clear competitive advantages, such as hydrogen production in Spain or green steel in Sweden. Some form of specialization is likely required at the EU level. Building continental value chains that leverage each country's competitive advantages should be a joint priority. Although all European countries have national energy and climate strategies, these are not yet explicitly linked with industrial objectives. Reinforced planning exercises can contribute usefully to this. The EU should encourage subsector-level planning to organize its industrial policy, following examples such as Sweden's net-zero exercise. At EU level, a vision of the future of the European industry should be developed to discuss trade-offs between geographies and plan the necessary infrastructure, based on subsector and national exercises. This could lead to changes in EU policymaking, but functions need to be clearly identified: establishing a long-term vision, selecting strategic sectors and territories, developing infrastructure, and ensuring policy design and monitoring are transparent.

Fifth, **socioeconomic impacts of industrial transitions** should be better analyzed and inform industrial policies. Current funding mechanisms such as the Just Transition Fund are insufficient to support regional reconversion incurred by the clean transition as implications go way beyond the focus on coal-dependent regions. Innovative approaches building on territorial measures linked to infrastructure, such as the call for tenders for grid connections in Spain, are worth exploring. The current Commission's effort to develop comprehensive roadmaps for

employment and skills and establish a robust just transition observatory should serve as a basis to evaluate the needs and opportunities linked to the European industrial transformation.

Sixth, the **reorganization of global value chains** is a central feature in current industrial transformation and policies. The impact of EU policy choices on the rest of the world should also be better informed and included systematically in policy decisions.

Finally, the EU should define and adopt a targeted approach to EU preferences and trade and investments partnerships based on an assessment of strategic technologies and activities for the EU and in dialogue with trade partners' expectations and needs. These EU preference policies can be compatible with redefining economic partnerships around the industrial transition, provided the EU develops a cleared and shared view among different Member States of its specialization and adopts a targeted approach in deploying the EU preferences in strategic activities. Such a targeted approach is not antagonistic to open trade as the reduction of supply chain risk through autarky would be far more costly than collective actions to reduce these risks.

New industrial policies: lessons for the EU and the Clean Industrial Deal

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The Institute for Sustainable Development and International Relations (IDDRI) is an independent think tank that facilitates the transition towards sustainable development. It was founded in 2001. To achieve this, IDDRI identifies the conditions and proposes the tools for integrating sustainable development into policies. It takes action at different levels, from international cooperation to that of national and sub-national governments and private companies, with each level informing the other. As a research institute and a dialogue platform, IDDRI creates the conditions for a shared analysis and expertise between stakeholders. It connects them in a transparent, collaborative manner, based on leading interdisciplinary research. IDDRI then makes its analyses and proposals available to all. Four issues are central to the institute's activities: climate, biodiversity and ecosystems, oceans, and sustainable development governance.
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