Advancing the Energy Transition through Industrial Policy: Lessons from a Transatlantic Comparison

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A. Introduction

Following years of mostly incremental progress, the urgency of climate change has increased pressure for a more transformative approach to decarbonization of the economy. Recently, this challenge has given rise to a growing trend towards deployment of green industrial policy to accelerate the transition from a fossil-fuel-based economy to a sustainable, low-carbon alternative. This chapter traces efforts of the United States (U.S.) and the European Union (EU) to harness green industrial policies as a means of achieving committed climate targets alongside further social and economic objectives, and explores the merits and possible risks of their distinct approaches.

During the administration of President Joseph R. Biden, the U.S. took a series of bold legislative steps including the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA), marking a pronounced shift from past reliance on executive rulemaking to public support for the production and deployment of low-carbon technologies as well as infrastructural renewal.[1] Similarly, the EU, with its ambitious European Green Deal and its implementing legislation, has embraced a comprehensive industrial policy framework to drive the region towards climate neutrality by 2050.[2] Both jurisdictions have seen a recent pivot in their policy approaches following major elections, yet still offer insightful lessons for the role of industrial policy in the decarbonization of energy systems.

1 Daniel A Farber, 'Turning Point: Green Industrial Policy and the Future of U.S. Climate Action' (2024) 11 Texas A&M Law Review 303.

2 Reinhilde Veugelers/Simone Tagliapietra/Cecilia Trasi, 'Green Industrial Policy in Europe: Past, Present, and Prospects' (2024) 24 Journal of Industry, Competition and Trade 4.

Legislative efforts deployed in the U.S. and the EU offer alternative models of how green industrial policy can facilitate the energy transition. While both jurisdictions have deployed a portfolio of measures, the U.S. approach has been dominated by fiscal incentives,[3] whereas the EU has deployed a more balanced combination of support measures and constraints.[4] In its exploration of the role of green industrial policy in accelerating the energy transition on both sides of the Atlantic, this chapter begins by defining green industrial policy and tracing its historical evolution (Section B). It then outlines the green industrial policy strategies of the United States and the European Union (Section C), and offers a comparative analysis that summarizes findings of the chapter and highlights risks and merits of each approach (Section D).

B. The Rise of Green Industrial Policy

Industrial policy – defined as government interventions that alter the structure of an economy, encouraging resources to move into sectors that are seen as desirable for future development[5] – has historically elicited mixed reactions. From criticism of its potential to distort markets[6] to acknowledg-

3 John ET Bistline/Neil Mehrotra/Catherine Wolfram, 'Economic Implications of the Climate Provisions of the Inflation Reduction Act' (Brookings 2023) <https://www.brookings.edu/wp-content/uploads/2023/03/BPEA_Spring2023_Bistline-et-al_unembargoedUpdated.pdf> accessed 26 August 2024.

4 Simone Tagliapietra/Reinhilde Veugelers, 'Developing a Green Industrial Policy for the European Green Deal' in Fernando J Díaz López/Massimiliano Mazzanti/Roberto Zoboli (eds), Handbook on Innovation, Society and the Environment (Edward Elgar Publishing 2023) 36.

5 Tilman Altenburg/Claudia Assmann, 'Green Industrial Policy: Concept, Policies, Country Experiences' (UN Environment 2017) <https://wedocs.unep.org/bitstream/handle/20.500.11822/22277/Green_industrial_policy.pdf> accessed 26 August 2024.

6 Reda Cherif/Fuad Hasanov, 'The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy' (International Monetary Fund 2019) Working Paper 2019/074 <https://www.imf.org/en/Publications/WP/Issues/2019/03/26/The-Return-of-the-Policy-That-Shall-Not-Be-Named-Principles-of-Industrial-Policy-46710> accessed 26 August 2024; Shantayanan Devarajan, 'Three Reasons Why Industrial Policy Fails' (Brookings, 2016) <https://www.brookings.edu/articles/three-reasons-why-industrial-policy-fails>; Michelle Clark Neely, 'The Pitfalls of Industrial Policy' (1993) 1 The Regional Economist 10.

ment – in some cases even by earlier skeptics[7] – of its role in fostering economic growth and technological advancement, industrial policy has traditionally stirred forceful opinions. An initial wave of public debate about its merits and shortcomings was occasioned by the success of Japanese efforts to accelerate the economic recovery after World War II, in the process turning the country into a dominant exporter of commodities and consumer products.[8]

While western nations had certainly been known to resort to market interventions in support of vulnerable or strategic industries, the prevailing sentiment at the time – overshadowed by the broader geopolitical conflict between capitalist free-market and centrally planned economies – held that the costs of industrial policy outweighed its benefits.[9] More recently, however, interest in industrial policy has been renewed by the global ascent of Chinese manufacturing, which has likewise benefited from substantial government intervention and prompted accusations of unfair trade practices that have contributed to competitive distortions and excess supplies in key markets.[10]

Recent efforts to take stock of Chinese industrial policy initiatives have affirmed a surge especially in direct government subsidies, finding these to be several times higher than those in Europe and North America.[11] Still, research published by the International Monetary Fund has shown that the

7 Paul Krugman, 'How to Think About Green Industrial Policy' (New York Times, 9 May 2023); compare to Paul Krugman, 'Targeted Industrial Policies: Theory and Evidence' (1983) Proceedings: Economic Policy Symposium – Jackson Hole 123.

8 James E Vestal, 'Japanese Industrial Policy, Past and Future' in James E Vestal (ed), Planning for Change: Industrial Policy and Japanese Economic Development, 1945–1990 (Oxford University Press 1995).

9 See, in particular, Lester C Thurow, Head to Head: The Economic Battle Among Japan, Europe, and America (William Morrow & Co 1992); and earlier Richard N Cooper, 'Industrial Policy and Trade Distortion: A Policy Perspective' in Ali M El-Agraa (ed), Protection, Cooperation, Integration and Development: Essays in Honour of Professor Hiroshi Kitamura (Palgrave Macmillan UK 1987) <https://doi.org/10.1007/978-1-349-09370-0_3> accessed 26 August 2024.

10 Ravi Agrawal, 'The White House's Case for Industrial Policy' (*Foreign Policy*, 2 March 2023) <https://foreignpolicy.com/2023/03/02/live-industrial-policy-katherine-tai-trade-economy-chips-inflation> accessed 26 August 2024; Gerard DiPippo/Ilaria Mazzocco/Scott Kennedy, 'Red Ink: Estimating Chinese Industrial Policy Spending in Comparative Perspective' (Center for Strategic and International Studies (CSIS) 2022) <https://www.csis.org/analysis/red-ink-estimating-chinese-industrial-policy-spending-comparative-perspective> accessed 12 August 2024.

11 Wan-Hsin Liu et al., 'Foul Play? On the Scale and Scope of Industrial Subsidies in China' (Kiel Institute for the World Economy 2024) Policy Brief 173 <https://www.if

current wave of industrial policy activity is primarily driven by advanced economies, with subsidies again the most employed instrument.[12] A further trend with consequential implications is the inclusion of restrictions – such as local content requirements (LCRs) – in a vast majority of such subsidies, distorting international trade and prompting retaliatory measures from trade partners that increasingly threaten to fragment the global economy.[13]

Unlike earlier rounds of public debate on industrial policy, however, the current discussion is also influenced by the simultaneous need to respond to climate change and deliver political responses that advance investment in low-carbon technology manufacturing and deployment. For instance, the probably most aggressive example of contemporary industrial policy, the Chinese 'Made in China 2025' strategy, is heavily oriented towards supporting low-carbon technologies identified as 'strategically important', such as electric vehicles and renewable energy.[14]

Whereas traditional industrial policy has focused on productivity enhancement as a lever to ensure growing returns to capital and labor, this current wave of industrial policies also pursues sustainability goals and seeks to advance the requisite structural transformation of the economy. Often described with the label 'green industrial policy', its stated goal is to align social and economic interests with environmental policy outcomes.[15] By fostering an ecosystem conducive to the development and scaling of clean energy technologies, green industrial policies promise to catalyze

w-kiel.de/publications/foul-play-on-the-scale-and-scope-of-industrial-subsidies-in-china-32738> accessed 26 August 2024.

12 Simon Evenett et al., 'The Return of Industrial Policy in Data' (International Monetary Fund (IMF) 2024) Working Paper 2024/001 <https://www.imf.org/en/Publications/WP/Issues/2023/12/23/The-Return-of-Industrial-Policy-in-Data-542828> accessed 26 August 2024.

13 Réka Juhász/Nathan J Lane, 'The Political Economy of Industrial Policy' (National Bureau of Economic Research 2024) Working Paper 32507 <http://www.nber.org/papers/w32507> accessed 26 August 2024.

14 State Council, 'Notice of the State Council on the Publication of "Made in China 2025" (Unofficial Translation)' <https://cset.georgetown.edu/wp-content/uploads/t0432_made_in_china_2025_EN.pdf>; Similarly, the 14th Five-Year Plan sets out a mandate to 'develop and expand strategic emerging industries', see National People's Congress, 'The 14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through the Year 2035' <http://www.gov.cn/xinwen/2021-03/13/content_5592657.htm> accessed 26 August 2024.

15 Dani Rodrik, 'Green Industrial Policy' (2014) 30 Oxford Review of Economic Policy 469.

new industries, spur employment opportunities, and stimulate economic diversification.[16]

Several factors have favored the emergence of green industrial policy as a key strategy to address several interrelated priorities: deep economic shocks, rising geopolitical tensions, and the growing urgency of climate action. It first garnered widespread attention in the wake of the economic and financial crisis of 2008, when a 'green recovery' was advocated as a dual engine of economic revival and environmental sustainability.[17] Later, China's assertive move to dominate low-carbon technology manufacturing spurred a broader shift towards green industrial policy, highlighting the competitive and strategic dimensions of leadership in the transition to clean energy.[18]

More recently, the adoption of green industrial policies by the U.S. and the EU has also been justified by a strategic need to enhance energy security and fortify low-carbon technology supply chains against the backdrop of global challenges such as the COVID-19 pandemic and escalating geopolitical tensions.[19] A steady acceleration of climate policy ambition, both in international agreements and through national commitments, has also contributed to a growing sense that state intervention is justified beyond mere correction of market failures, for instance to address the high initial costs and attendant risks of relevant climate solutions, while also managing the social impacts and evolving workforce needs of a just energy transition.[20]

Its astonishing rise notwithstanding, the embrace of green industrial policy has also evinced concerns. Critics highlight the risks of policy misalign-

16 Jonas Nahm, Collaborative Advantage: Forging Green Industries in the New Global Economy (Oxford University Press 2021).

17 Edward B Barbier, A Global Green New Deal: Rethinking the Economic Recovery (Cambridge University Press 2010).

18 Joanna I Lewis, 'The Climate Risk of Green Industrial Policy' (2024) 123 Current History 14.

19 Miranda A Schreurs, 'Jockeying for Climate Leadership Amidst Rising Global Tensions: China, USA and the European Union' in Sebastian Biba (ed), Europe in an Era of US-China Strategic Rivalry: Challenges and Opportunities from an Outside-in Perspective (Springer Nature Switzerland 2024) 243.

20 Francesco Lamperti et al., 'The Green Transition: Public Policy, Finance, and the Role of the State' (2019) 88 Vierteljahrshefte zur Wirtschaftsforschung 73; going back to Mariana Mazzucato, The Entrepreneurial State: Debunking Public vs. Private Sector Myths (Anthem Press 2013); for a review of the evolving literature on industrial policy, see Réka Juhász/Nathan Lane/Dani Rodrik, 'The New Economics of Industrial Policy' (2024) 16 Annual Review of Economics 213.

ment leading to market distortions, where poorly calibrated policies might inadvertently hinder innovation by funneling resources into less efficient or unproven technologies, crowding out private investment, and nurturing rent-seeking behavior and reliance on governmental support rather than genuine market competitiveness.[21] Likewise, the aforementioned specter of protectionism and its threat to the international economic order is also evident in green industrial policy.[22]

Despite such risks, green industrial policy can play a beneficial role in advancing the global energy transition. Targeted support for research and development in low-carbon technologies can hasten innovation breakthroughs,[23] thereby contributing to decarbonization efforts everywhere. In a climate policy landscape marked by asymmetric climate action under the decentralized architecture of the Paris Agreement, declining low-carbon technology costs may prove essential to overcoming freeriding incentives, competitiveness concerns, and negative spillover effects such as emissions leakage.[24] Additionally, deployment of green industrial policy can also contribute to more diversified and resilient supply chains for rare earth metals and other critical materials and components, reversing excessive reliance on individual countries such as China.[25]

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21 See, for instance, Scott Lincicome/Huan Zhu, 'Questioning Industrial Policy: Why Government Manufacturing Plans Are Ineffective and Unnecessary' (Cato Institute 2021) White Paper <https://www.cato.org/sites/cato.org/files/2021-09/white-paper-questioning-industrial-policy-updated.pdf> accessed 26 August 2024.

22 Kimberly A Clausing/Catherine Wolfram, 'Putting Progress over Protectionism in Climate Policy' (RealTime Economics, 19 December 2023) <https://www.piie.com/blogs/realtime-economics/putting-progress-over-protectionism-climate-policy> accessed 30 March 2024; Joanna I Lewis, 'The Rise of Renewable Energy Protectionism: Emerging Trade Conflicts and Implications for Low Carbon Development' (2014) 14 Global Environmental Politics 10.

23 Mariana Mazzucato, 'Financing the Green New Deal' (2022) 5 Nature Sustainability 93; David C Popp, 'Innovation and Climate Policy' (2010) 2 Annual Review of Resource Economics 275.

24 See, for instance, the global spillover benefits from solar energy support policies adopted in selected jurisdictions, Todd D Gerarden, 'Demanding Innovation: The Impact of Consumer Subsidies on Solar Panel Production Costs' (2023) 69 Management Science 7799; John Paul Helveston/Gang He/Michael R Davidson, 'Quantifying the Cost Savings of Global Solar Photovoltaic Supply Chains' (2022) 612 Nature 83.

25 Andreas Goldthau/Llewelyn Hughes, 'Protect Global Supply Chains for Low-Carbon Technologies' (2020) 585 Nature 28; Andreas Goldthau/Llewelyn Hughes/Jonas Nahm, 'The Political Logic of Reshoring in Low Carbon Technologies: Economic Interdependence and Green Industrial Policy' (2022) <https://papers.ssrn.com/abstract=4066047> accessed 26 March 2024; Jan Mertens et al., 'From Emissions

While discourses on green industrial policy may continue to oscillate between advocacy of its prospective benefits and concern about its potential risks, policy makers grappling with the need to advance decarbonization are likely to continue drawing on this policy option, not least at a time when climate policy features prominently on electoral agendas worldwide.[26] In a world of increasingly fragmented markets and growing geopolitical competition, that is likely to remain the case even as priorities evolve and some jurisdictions withdraw – at least temporarily – from efforts to decarbonize their economies. Ongoing evaluation of green industrial policies is therefore of continued relevance, as is understanding lessons derived from their design and implementation. Accordingly, the next section describes specific green industrial policy initiatives deployed in recent years in the United States and the European Union, and assesses their potential impact on the prospects of the energy transition and industrial decarbonization.

C. Transatlantic Approaches to Green Industrial Policy

1. Green Industrial Policy in the United States

(a) Background and Context

Although a notoriously unsteady actor in domestic and international climate policy, the United States has nonetheless pioneered the use of industrial policy in ways that have influenced other actors, including the EU. Lessons learned in the process therefore bear careful study as other jurisdictions – and indeed future U.S. administrations – turn to industrial policy to advance climate policy objectives and the decarbonization of energy systems.

U.S. deployment of green industrial policy can be traced back to the environmental movement of the 1960s and 1970s, which catalyzed the enactment of landmark legislation such as the Clean Air Act and the Clean Water Act. While these early efforts lacked an explicit link to industrial policy, they set the stage for subsequent discussions on sustainable industrial

to Resources: Mitigating the Critical Raw Materials Supply Chain Vulnerability of Renewable Energy Technologies' (2024) Mineral Economics <https://doi.org/10.1007/s13563-024-00425-2> accessed 26 August 2024.

26 David M Driesen/Michael A Mehling/David C Popp, 'Industrial Policy, Populism, and the Political Economy of Climate Action' (2024) 14 Nature Climate Change 414.

practices.[27] Environmental discourses eventually shifted political focus to climate change and the need for a low-carbon energy transition, with growing recognition of the role of government policy in supporting relevant industries.[28]

The American Recovery and Reinvestment Act of 2009, for instance, represented a significant investment in clean energy and environmental projects, highlighting the role of federal policy in catalyzing the transition to a green economy.[29] A generational economic crisis and the urgent need for job creation and economic revitalization presented a compelling case for investment in clean technologies and sustainable industries as a pathway to economic recovery and long-term sustainability.[30]

More recently, the Green New Deal resolution, introduced in Congress in 2019, marked a watershed moment in the U.S. discourse on climate policy and decarbonization.[31] Though not a legislative act, it articulated a vision for a comprehensive transformation of the economy to address climate change, social inequality, and economic stagnation through massive investments in low-carbon energy, infrastructure, and green jobs. This resolution reflected political preferences articulated across the left spectrum of the political landscape, and strongly influenced subsequent policy proposals.[32]

Following introduction of the Green New Deal, legislative efforts, including the Inflation Reduction Act,[33] Infrastructure Investment and Jobs Act,[34] and executive orders focused on clean energy and environmental sustain-

27 Farber (n 1).
28 Schreurs (n 19).
29 American Recovery and Reinvestment Act of 2009 (ARRA) 115.
30 Joseph E Aldy, 'A Preliminary Assessment of the American Recovery and Reinvestment Act's Clean Energy Package' (2013) 7 Review of Environmental Economics and Policy 136; Sanya Carley/Sean Nicholson-Crotty/Eric J Fisher, 'Capacity, Guidance, and the Implementation of the American Recovery and Reinvestment Act' (2015) 75 Public Administration Review 113.
31 Alexandria Ocasio-Cortez, 'Recognizing the Duty of the Federal Government to Create a Green New Deal' H.R. Res. 109 2019 [109].
32 Jon Bloomfield and Fred Steward, 'The Politics of the Green New Deal' (2020) 91 The Political Quarterly 770; David G Victor/Emily K Carlton, 'Technology to Solve Global Problems: An Emerging Consensus for Green Industrial Policy?' (2023) 18 Environmental Research Letters 091006.
33 To provide for reconciliation pursuant to title II of S. Con. Res. 14 2022 1818.
34 An act to authorize funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes 2021 429.

ability,[35] further solidified the U.S. embrace of green industrial policy. These efforts emphasized the role of the federal government in fostering innovation, supporting sustainable industries, and ensuring U.S. competitiveness in the global transition to a green economy.

Importantly, however, the deployment of industrial policy to advance decarbonization and other environmental objectives has by no means been a linear process. Periodically, the highly polarized nature of climate policy discourses has prompted consequential policy reversals, as witnessed most recently during the second administration of President Donald J. Trump. Already during his first year in office, signature policy successes of his predecessor – including executive rulemaking and legislative breakthroughs such as the IRA – were significantly curtailed or altogether abandoned.

The historical evolution of green industrial policy in the United States thus illustrates a complex and not always linear trajectory of using government intervention to combine environmental policy objectives with economic growth. From early environmental regulations to more recent legislative and policy initiatives that focus on advancing clean technology manufacturing and renewable energy production, the rise of green industrial policy reflects a growing sense that policies have to simultaneously advance economic, social, and environmental objectives in order to remain viable in a polarized political context.

(b) Central Features of U.S. Green Industrial Policy

The evolution of green industrial policy in the U.S. has been shaped by both legislative and executive initiatives, which have propelled and shaped the direction of policy development and implementation. Notable legislative efforts, such as the American Recovery and Reinvestment Act of 2009,[36] marked early attempts to integrate green investments into broader economic recovery measures. However, the push towards a cohesive green industrial policy gained momentum with more recent initiatives that explicitly

35 See, e.g., Executive Office of the President, 'Executive Order 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability' <https://www.federalregister.gov/documents/2021/12/13/2021-27114/catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability> accessed 5 September 2023.

36 ARRA (n 29).

targeted climate change and environmental sustainability as central pillars of economic policy.[37]

Following the 2020 general election, the Biden Administration played a decisive role in accelerating the U.S. pivot to green industrial policy. It was, in turn, heavily influenced by the introduction of the Green New Deal resolution in Congress,[38] which, although not enacted into law, framed the conversation on climate action within the broader context of social and economic reform, highlighting the interconnections between environmental sustainability, economic inequality, and social justice.[39] Guided by the recommendations of a 'Unity Task Force' appointed by Senator Bernard Sanders and presidential candidate Joseph R. Biden Jr., key elements of this progressive agenda found their way into Biden's electoral campaign platform.[40]

Soon after the election, the green industrial policy dimension of this political platform evolved into the 'Build Back Better' agenda, which eventually culminated – albeit in a diminished form, due to multiple political compromises required for passage – in the Infrastructure Investment and Jobs Act and Inflation Reduction Act. These acts represented landmark investments in clean energy, climate resilience, and environmental justice, reflecting a holistic approach that encompassed economic revitalization, job creation, and addressing the disproportionate impact of climate change on vulnerable communities.[41]

Chronologically the first of these legislative measures to pass in November 2021, the bipartisan Infrastructure Investment and Jobs Act (IIJA), earmarked $1.2 trillion towards revamping U.S. infrastructure, with a significant focus on sustainable and resilient systems.[42] Approximately $550 billion of new spending was allocated to various projects, including im-

37 Bistline/Mehrotra/Wolfram (n 3); Farber (n 1).

38 Alexandria Ocasio-Cortez, 'Recognizing the Duty of the Federal Government to Create a Green New Deal', H.R. Res. 109.

39 Schreurs (n 19); Victor/Carlton (n 32).

40 John Kerry et al., 'Biden-Sanders Unity Task Force Recommendations: Combating the Climate Crisis and Pursuing Environmental Justice' (2020) <https://joebiden.com/wp-content/uploads/2020/08/UNITY-TASK-FORCE-RECOMMENDATIONS.pdf> accessed 26 August 2024.

41 White House, 'Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action' <https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf> accessed 26 August 2024.

42 Infrastructure Investment and Jobs Act.

provements to public transit, water infrastructure, and broadband access, as well as initiatives specifically aimed at bolstering the country's climate resilience and reducing greenhouse gas emissions. A notable aspect of the Act was its investment in electric vehicle (EV) infrastructure, aiming to create a nationwide network of EV chargers to facilitate the transition to electric transportation. Additionally, the IIJA appropriated funds to upgrade the electrical grid, addressing one of the most serious bottlenecks currently holding back more rapid deployment of renewable energy sources.[43]

Adopted the following year on a purely partisan vote, the CHIPS and Science Act of 2022 focused on strengthening the United States' semiconductor industry and scientific research infrastructure, recognizing the critical role of technology and innovation in economic competitiveness and national security.[44] The Act authorized approximately $280 billion in federal investments for semiconductor research, development, and manufacturing incentives, alongside substantial funding for science and technology research initiatives. While it primarily aimed to bolster the U.S. position in the global technology race, it acknowledged the strategic importance of semiconductors in a range of industries, including clean energy technologies, where advanced materials and components are essential for innovation and efficiency improvements. Not only did it indirectly advance the broader goals of U.S. green industrial policy by investing in the semiconductor industry and scientific research, but it also appropriated up to $67 billion to fund research directly relevant to decarbonization, including research on advanced zero-emissions technologies such as improved energy storage, hydrogen, carbon capture and storage, and fusion, greenhouse gas management, climate science research, as well as disaster-resilience research.[45]

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43 Richard G Smead, 'Infrastructure Permitting and Friction in the Energy Transition' (2024) 40 Climate and Energy 27.

44 Making appropriations for Legislative Branch for the fiscal year ending September 30, 2022, and for other purposes 2022 1366. CHIPS stands for 'Creating Helpful Incentives to Produce Semiconductors'.

45 Robinson Meyer, 'Congress Just Passed a Big Climate Bill. No, Not That One.' (The Atlantic, 10 August 2022) <https://www.theatlantic.com/science/archive/2022/08/chips-act-climate-bill-biden/671095> accessed 31 March 2024; John F Sargent Jr./Manpreet Singh/Karen M Sutter, 'Frequently Asked Questions: CHIPS Act of 2022 Provisions and Implementation' (Congressional Research Service 2023) CRS Report R47523 <https://crsreports.congress.gov/product/pdf/R/R47523> accessed 26 August 2024.

In August 2022, finally, Congress narrowly passed the Inflation Reduction Act (IRA) on a partisan vote through the reconciliation process to avoid a potential filibuster in the U.S. Senate.[46] Hailed as the "most important climate action in U.S. history",[47] this measure sought to enhance energy security and bolster green innovation through a range of public investments in the form of tax credits, grants, loans and other subsidies. Overall investment volumes in climate change mitigation and adaptation remained uncertain, but were substantial, with the initial estimate by the Congressional Budget Office of $369 billion over a decade representing the lower end of projections.[48] Other calculations anticipated greater uptake of the uncapped tax credits, which would have increased the budgetary costs of the Inflation Reduction Act to levels up to three times higher than the official estimate.[49] A large share of funds appropriated under the Inflation Reduction Act was earmarked for the direct promotion of manufacturing in low-carbon technologies, with many of the incentives conditional on local content or assembly requirements aimed at relocating advanced technology manufacturing to the United States.

Specifically, the Inflation Reduction Act introduced several mechanisms designed to incentivize private investment in clean technologies and manufacturing. It earmarked an estimated $30 billion in production tax credits to accelerate U.S. manufacturing of solar panels, wind turbines, batteries, and critical minerals processing, a $10 billion investment tax credit to build clean technology manufacturing facilities, $20 billion in loans to establish new clean vehicle manufacturing facilities across the country, various grants and tax credits to reduce emissions from industrial manufacturing processes, including almost $6 billion for a new Advanced Industrial Facilities Deployment Program to reduce emissions from the largest industrial emitters like chemical, steel and cement plants, and over $9 billion for

46 Inflation Reduction Act of 2022.

47 Silvio Marcacci, 'The Inflation Reduction Act Is The Most Important Climate Action In U.S. History' (Forbes, 2022) <https://www.forbes.com/sites/energyinnovation/2022/08/02/the-inflation-reduction-act-is-the-most-important-climate-action-in-us-history> accessed 31 March 2024.

48 Congressional Budget Office, 'Estimated Budgetary Effects of Public Law 117–169, to Provide for Reconciliation Pursuant to Title II of S. Con. Res. 14' (Congressional Budget Office 2022) <https://www.cbo.gov/ publication/58455suisse> accessed 1 April 2023.

49 Bistline/Mehrotra/Wolfram (n 3); Credit Suisse, 'US Inflation Reduction Act: A Tipping Point in Climate Action' (Credit Suisse 2022) ESG Report <https://www.credit-suisse.com/treeprintusinflationreductionact> accessed 26 August 2024.

public procurement of clean technologies to create a stable market for clean products.[50] Additionally, substantial incentives for low-carbon electricity and fuels were intended to accelerate the decarbonization of the energy system, lowering the indirect emissions of U.S. producers.

Uniquely, the Inflation Reduction Act also addressed the social dimensions of the energy transition, allocating funds to disadvantaged communities and workers affected by the shift away from fossil fuels. This approach reflected the political strategy of ensuring that the benefits of the green economy are widely shared, promoting equity and environmental justice as central tenets of U.S. climate action, to secure broad public acceptance and political support.[51]

Beyond the foregoing legislative measures of the U.S. Congress, the Biden administration issued a number of executive orders that were aimed at advancing the green industrial policy agenda, setting targets for greenhouse gas emission reductions, promoting the sustainability of federal land, buildings, and procurement practices, and enhancing the resilience of critical infrastructure to climate change. Notably, the Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability outlined significant efforts by the U.S. government to bolster environmental and energy efficiency across federal operations.[52] It revoked previous orders, aiming for a more robust and comprehensive approach to sustainability within federal agencies by emphasizing the transition to carbon pollution-free electricity, sustainable acquisition and procurement, and adapting federal operations to climate change impacts. The order set out several climate policy objectives, such as achieving a substantial percentage of zero-emission vehicle acquisitions by 2035 and a net-zero emissions building portfolio by 2045, and committed the administration to reducing emissions and supporting resilient supply chains through prioritized purchasing decisions favoring sustainable products and services. These actions were set to leverage the considerable purchasing power of the federal government to advance domestic policy objectives.

50 Andrei Marcu/Michael A Mehling/Aaron J Cosbey, 'CBAM in a Portfolio of Measures for Industrial Decarbonization' (European Roundtable on Climate Change and Sustainable Transition (ERCST) 2023) <https://ercst.org/cbam-in-a-portfolio-of-measures-for-industrial-decarbonization> accessed 31 March 2024.

51 Farber (n 1).

52 Executive Office of the President (n 35).

Finally, federal agencies and their executive rulemaking have been key components of the U.S. green industrial policy framework. Specifically, the Environmental Protection Agency (EPA) and the Department of Energy (DoE) play critical roles in implementing and enforcing regulations that support the transition to clean energy and sustainable practices. During the Biden administration, for instance, the Department of Energy announced an investment of $6 billion to accelerate innovation in clean energy technologies and foster partnerships between the government, private sector, and research institutions designed to reduce barriers to innovation and market entry.[53]

Much of the industrial policy agenda of the Biden administration was put to question when Donald J. Trump won the 2024 presidential election. One of his first measures on Inauguration Day was the adoption of an Executive Order revoking virtually all Executive Orders of his predecessor, including those related to green industrial policy and decarbonization.[54] In July 2025, Republican majorities in the U.S. House of Representatives and Senate also curtailed most fiscal incentives set out in the IRA.[55] Although grants and loans under that legislation had largely been awarded under the previous administration, actual disbursement was in many cases suspended pending further review by the Trump administration. Likewise, the new administration quickly began reviewing any proposed or adopted agency rules seeking to address climate change, forestalling their expected judicial review and possible recission by the Supreme Court as a result of the 2024 decision in *Loper Bright v Raimondo*.[56] Recent progress achieved with green industrial policy in the U.S. thus stands to stall or reverse, although the market forces it unleashed continue to drive investment in decarbonization.

53 Department of Energy, 'Biden-Harris Administration Announces $6 Billion to Transform America's Industrial Sector, Strengthen Domestic Manufacturing, and Slash Planet-Warming Emissions' <https://www.energy.gov/articles/biden-harris-administration-announces-6-billion-transform-americas-industrial-sector> accessed 31 March 2024.

54 Executive Office of the President, 'Executive Order 14148: Initial Rescissions of Harmful Executive Orders and Actions' <https://www.federalregister.gov/documents/2025/01/28/2025-01901/initial-rescissions-of-harmful-executive-orders-and-actions> accessed 15 July 2025.

55 To provide for reconciliation pursuant to title II of H. Con. Res. 14 2025 (One Big Beautiful Bill Act).

56 Supreme Court of the United States, *Loper Bright Enterprises, et al. v. Gina Raimondo, Secretary of Commerce, et al. Relentless, Inc. et al. v. Department of Commerce, et al.*, 28 June 2024, 144 S. Ct. 2244.

(c) Assessment

U.S. green industrial policy under the Biden administration, as exemplified by the IRA, IIJA, and CHIPS and Science Act, marked a significant pivot towards sustainable economic development and climate resilience. The cumulative impact of these policies has been profound, and was aimed at facilitating a comprehensive transformation across various sectors of the economy. From bolstering clean energy technologies to modernizing infrastructure and enhancing the nation's scientific and technological capabilities, these legislative efforts embodied a multifaceted approach to addressing the pressing challenges of climate change while ensuring economic growth and competitiveness. At the same time, the emphasis on sustainability and resilience in procurement practices, as guided by executive orders and departmental strategies, underscored a commitment to embedding environmental considerations into the fabric of federal operations.

Estimates suggest that these legislative measures – if fully operationalized by federal agencies – would have helped substantially narrow the gap between projected emissions and the Nationally Determined Contribution (NDC) submitted in 2021 by the Biden administration,[57] which required emissions to decline by 50–52 % below 2005 levels in 2030.[58] Impacts of these green industrial policy efforts did not only manifest themselves in terms of anticipated emission reductions, however. Already in the first year after its adoption, the IRA and the generous incentives it set out were seen as critical enablers for a 37 % increase in new clean energy and technology investment across the U.S. economy, and a 125 % year-on-year increase in clean technology manufacturing, particularly within electric vehicle and solar manufacturing.[59] Investment in clean energy production and industrial decarbonization also rose 15 % year-on-year, and household and business

57 John ET Bistline et al., 'Emissions and Energy Impacts of the Inflation Reduction Act' (2023) 380 Science 1324; Jesse D Jenkins and others, 'Climate Progress and the 117th Congress: The Impacts of the Inflation Reduction Act and Infrastructure Investment and Jobs Act' (Princeton University 2023) <https://repeatproject.org/docs/REPEAT_Climate_Progress_and_the_117th_Congress.pdf> accessed 26 August 2024.

58 United States, 'The United States' Nationally Determined Contribution. Reducing Greenhouse Gases in the United States: A 2030 Emissions Target' <https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%2021%202021%20Final.pdf> accessed 26 August 2024.

59 Lily Bermel and others, 'The Clean Investment Monitor' (MIT Center for Energy and Environmental Policy Research (CEEPR) 2013) <https://www.cleaninvestmentmonitor.org/reports/202309> accessed 26 March 2024 accessed 26 August 2024.

retail investment in purchasing and installing clean technologies such as heat pumps and zero-emission vehicles (ZEVs) rose 32 % year-on-year.[60]

Unlike more conventional climate policy approaches, U.S. green industrial policy during the Biden administration represented an integrated approach to climate change mitigation and adaptation, economic strategy, and national security. As a result, many observers expected that a change in U.S. leadership after the 2024 elections would see the incoming administration tacitly or overtly continue the focus on technological innovation, workforce development, and broad access to the economic benefits of these policies, not least since a majority of clean energy activities benefitting from investment under legislation such as the Inflation Reduction Act were said to be located in Republican congressional districts.[61]

For many, therefore, the intensity and speed with which the Trump administration began dismantling key elements of the previous administration's industrial policy agenda came as a surprise. Not only does that policy reversal offer lessons about the political economy of climate action in a polarized political context, but it has also dramatically undermined the ability of the U.S. to achieve meaningful progress on decarbonization. Early assessments of the impact of executive and legislative repeal measures during the Trump administration, for instance, estimated that U.S. deployment of renewable energy would be 72 % lower over a decade,[62] and greenhouse gas emissions would increase by roughly 190 million metric tons per year in 2030 and 470 million tons in 2035.[63] Likewise, uncertainty about the evolving policy context began impacting new investment in clean technology manufacturing as early as the first quarter of 2025, which showed a marked

60 ibid.

61 Jeffrey Kupfer, 'The Conservative Case for Keeping the Inflation Reduction Act' (*The Hill*, 18 March 2024) <https://thehill.com/opinion/energy-environment/4538435-the-conservative-case-for-keeping-the-inflation-reduction-act/> accessed 31 March 2024; Kelsey Tamborrino/Josh Siegel, 'Big Winners from Biden's Climate Law: Republicans Who Voted against It' (*POLITICO*, 23 January 2023) <https://www.politico.com/news/2023/01/23/red-states-are-winning-big-from-dems-climate-law-00078420> accessed 31 March 2024.

62 Ben King and others, 'Ways and Means Brings the Hammer Down on Energy Credits' (Rhodium Group 2025) <https://rhg.com/research/ways-and-means-brings-the-hammer-down-on-energy-credits> accessed 15 July 2025.

63 Jesse D. Jenkins and others, 'Impacts of the One Big Beautiful Bill on the US Energy Transition' (REPEAT Project 2025) <https://doi.org/10.5281/zenodo.15801701> accessed 15 July 2025.

decrease relative to the preceding quarter after several years of accelerated growth.[64]

Of course, critics of industrial policy had previously pointed out that the approach chosen by the Biden administration was both costly and fraught with risk.[65] Still, few would have anticipated the rapid policy reversal and associated impacts on industry and households, including stranded assets and abandoned projects, heightened investment risk, and increased energy costs, that the Trump administration and its allies in Congress have been willing to tolerate in order to advance their fiscal policy agenda. Even demonstrated environmental, social, and economic benefits – including a concentration of induced investments in Republican districts – were insufficient to insulate the Biden administration's industrial policy efforts from partisan politics and thereby improve their political durability, a key advantage ascribed to green industrial policy over traditional climate policies. As such, the fleeting industrial policy turn in the U.S. serves as a cautionary tale of both its potential and political vulnerability.

2. Green Industrial Policy in the European Union

(a) Background and Context

Europe's journey towards establishing a green industrial policy framework can be traced back to the early recognition of environmental protection as a foundational pillar of its collective policy agenda. Over the last three decades, EU climate policy has evidenced a consistent trend of international leadership and progressively rising ambition on climate change mitigation, with Brussels increasingly exercising its legislative powers and claiming an expanding institutional mandate, greater responsibilities, and new areas of integration.[66] European leadership in climate and energy policy is

64 Rhodium Group and others, 'Clean Investment Monitor: Q1 2025 Update' (MIT Center for Energy and Environmental Policy Research 2025) <https://www.cleaninvestmentmonitor.org/reports/q1-2025-update> accessed 15 July 2025.

65 Adam Posen, 'America's Zero-Sum Economics Doesn't Add Up' (Foreign Policy, 2 April 2024) <https://foreignpolicy.com/2023/03/24/economy-trade-united-states-china-industry-manufacturing-supply-chains-biden> accessed 30 March 2024.

66 Camilla Bausch/Benjamin Görlach/Michael Mehling, 'Ambitious Climate Policy through Centralization? Evidence from the European Union' (2017) 17 Climate Policy 32.

also an extension of broader trends in the process of European integration, with concerted action being perceived inside the EU as a unifying and urgent agenda, while simultaneously allowing it to enhance its international standing as a global actor. In response to its international commitments under the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), the EU adopted a European Climate Change Programme (ECCP) in 2000,[67] which was followed by a series of legislative measures aimed at reducing greenhouse gas emissions pollution and promoting sustainable practices across the Member States.

A landmark measure in this evolving policy landscape was the establishment of the EU Emissions Trading System (EU ETS) in 2005, the world's first major carbon market designed to cap and reduce greenhouse gas emissions from significant industrial emitters.[68] The EU ETS has represented a pioneering use of market-based mechanisms to drive environmental policy objectives, marking a dramatic pivot from earlier policy preferences of the EU, which had previously expressed skepticism about the instrument of emissions trading.[69] It presently operates in 30 countries – all 27 EU Member States of the EU as well as Iceland, Liechtenstein and Norway – and covers around 10,000 emitters in the power, heavy industry and aviation sectors accounting for roughly 40 % of EU GHG emissions. This makes the EU ETS a centerpiece of EU climate policy.[70] Over a dozen directives, regulations and decisions set out the legal framework of the

67 European Commission, 'Communication from the Commission to the Council and the European Parliament: EU Policies and Measures to Reduce Greenhouse Gas Emissions – Towards a European Climate Change Programme (ECCP)' COM (2000) 88 final' <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0088:FIN:EN:PDF> accessed 26 August 2024.

68 European Parliament and Council Directive 2003/87/EC of 13 October 2003 Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC [2003] OJ L275/32.

69 Harro van Asselt, 'Emissions Trading: The Enthusiastic Adoption of an "Alien" Instrument?' in Andrew Jordan et al. (eds), Climate Change Policy in the European Union: Confronting the Dilemmas of Mitigation and Adaptation? (Cambridge University Press 2010); Brettny Hardy, 'How Positive Environmental Policies Affected Europe's Decision to Oppose and Then Adopt Emissions Trading' (2006) 17 Duke Environmental Law & Policy Forum 297; Jørgen Wettestad, 'The Making of the 2003 EU Emissions Trading Directive: An Ultra-Quick Process Due to Entrepreneurial Proficiency?' (2005) 5 Global Environmental Politics 1.

70 Jos M Delbeke, 'The Emissions Trading Scheme (ETS): The Cornerstone of the EU's Implementation of the Kyoto Protocol' in Jos M Delbeke (ed), EU Energy Law, Vol. IV: The EU Greenhouse Gas Emissions Trading Scheme (Claeys & Casteels 2006).

EU ETS, extending the market to new sectors and gases, establishing a common registry, and providing technical guidance and procedural details on design features such as auctioning and emissions monitoring, reporting, and verification (MRV).[71]

The transition towards a more defined green industrial policy became more pronounced over the past decade, as the European public – and, in particular, a growing force of environmental activists, such as the 'Fridays for Future' movement – articulated increasing concern about the climate crisis and the urgency of an ambitious policy response.[72] The European response to this challenge has been characterized by a strategic pivot towards leveraging industrial policy as a key instrument for promoting environmental sustainability and economic resilience. This shift was initially articulated through various policy documents and communications that emphasized the importance of supporting industries and technologies critical to the transition to a low-carbon economy. Most notable among these is the European Green Deal (EGD) announced in July 2019 by the incoming European Commission President Ursula von der Leyen during her campaign to secure political confirmation by the European Parliament.[73] It set out a policy roadmap to "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050."[74]

Subsequent implementation measures included the European Climate Law, adopted as a regulation in June 2021, which enshrined in legally binding terms the aspiration to ensure a climate neutral European Union by

71 Damien Meadows et al., 'EU ETS: Pricing Carbon to Drive Cost-Effective Reductions across Europe', in Jos M Delbeke and Peter Vis (ed), EU Climate Policy Explained (Routledge 2015) 26.

72 Viktoria Spaiser/Nicole Nisbett/Cristina G Stefan, '"How Dare You?"—The Normative Challenge Posed by Fridays for Future' (2022) 1 PLOS Climate e0000053; Felix Noth/Lena Tonzer, 'Understanding Climate Activism: Who Participates in Climate Marches Such as "Fridays for Future" and What Can We Learn from It?' (2022) 84 Energy Research & Social Science 102360.

73 Ursula von der Leyen, 'Political Guidelines for the Next European Commission 2019–2024' (Publications Office of the European Union 2020) <https://data.europa.eu/doi/10.2775/101756> accessed 26 August 2024.

74 European Commission, 'Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal' COM (2019) 640 final' <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN> accessed 26 August 2024.

2050, and set a near term objective of a 55 % emissions reduction by 2030.[75] Additionally, a package of more than a dozen legislative and regulatory measures – the 'Fit for 55' package – was released in July 2021, with the individual measures gradually progressing towards passage through the legislative process between the European Parliament and the Council of the European Union.[76]

This ambitious agenda laid the foundation for an expansive suite of policy initiatives aimed at integrating green industrial policy more explicitly into the broader European economic strategy. For instance, the EU has sought to expand its policy toolset to include mechanisms such as the Carbon Border Adjustment Mechanism (CBAM), the Net Zero Industry Act, and the Critical Raw Materials Act (see *infra*, Section B), aiming to mitigate carbon leakage, promote clean industrial development, and ensure secure and sustainable supply chains.[77] More recently, it has heeded calls to strengthen its industrial base and economic competitiveness[78] by setting out elements of a Clean Industrial Deal.[79] In part, these measures can be seen as an EU response to U.S. industrial policy advances with the IRA, IIJA, and other initiatives that threatened to undermine industrial competitiveness and green leadership in Europe. Unlike the U.S., however, Europe

75 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 [2021] ('European Climate Law') 1.

76 Sabine Schlacke et al., 'Implementing the EU Climate Law via the "Fit for 55" Package' (2022) 1 Oxford Open Energy 1.

77 Sebastian Oberthür/Ingmar von Homeyer, 'From Emissions Trading to the European Green Deal: The Evolution of the Climate Policy Mix and Climate Policy Integration in the EU' (2023) 30 Journal of European Public Policy 445.

78 Mario Draghi, 'The Future of European Competitiveness' (European Commission 2024) <https://commission.europa.eu/topics/strengthening-european-competitiveness/eu-competitiveness-looking-ahead_en> accessed 15 July 2025.

79 European Commission, 'Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal' COM (2019) 640 final' <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN> accessed 26 August 2024; European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The Clean Industrial Deal – A Joint Roadmap for Competitiveness and Decarbonisation' COM (2025)85 <https://commission.europa.eu/document/download/9db1c5c8-9e82-467b-ab6a-905feeb4b6b0_en?filename=Communication%20-%20Clean%20Industrial%20Deal_en.pdf> last accessed 15 July 2025.

has been able to sustain its climate policy ambition, although only by deepening its reliance on industrial policy approaches that simultaneously pursue environmental, social, and economic objectives.

(b) Central Features of EU Green Industrial Policy

The EU's green industrial policy is framed within a complex political and regulatory context, characterized by ambitious policy initiatives aimed at addressing the dual challenges of climate change and economic competitiveness. Central to this context are the European Green Deal and Clean Industrial Deal, complemented by strategic legislative acts and regulations designed to promote a comprehensive and integrated approach to green industrial development. In terms of implementation, these two policy strategies are exceptionally broad and set out goals that extend across all major sectors, including energy, industry, transport, buildings, and agriculture, accompanied by a roadmap with a timetable for the introduction of specific policies and measures in each thematic area. Specifically, they identified a need for new policies to, inter alia: increase EU climate ambition for 2030 and 2050, through a review and revision of relevant climate policy instruments, including emissions trading and energy taxation, as well as adoption of a new European Climate Law; promote the supply of clean, affordable and secure energy, including prioritization of energy efficiency and development of a power sector based largely on renewable resources; mobilize industry for a clean and circular economy; accelerate the shift to sustainable and smart mobility through increased adoption of sustainable and alternative fuels in road, maritime and air transport, strengthened emission standards for combustion-engine vehicles, measures to encourage the adoption of low-emission vehicles; and, more recently, a plan to improve energy affordability, create lead markets for clean industrial products, and scale investment in clean manufacturing.[80]

Taken together, this detailed roadmap illustrates a scope that extends well beyond environmental objectives, targeting economic growth, social equity, and technological innovation as integral components of the European green transformation. In response to evolving global challenges, such as supply chain disruptions and geopolitical tensions, the EU has sought to ex-

80 European Commission, 'The European Green Deal' (n 74); European Commission, 'Clean Industrial Deal' (n 79.

pand its climate policy toolset to include elements of industrial policy.[81] EU green industrial policy is thus intricately linked to broader concerns regarding industrial competitiveness, supply chain resilience, and energy security. The COVID-19 pandemic and subsequent geopolitical tensions, notably the Russian invasion of Ukraine, have highlighted the vulnerabilities of global supply chains and the strategic importance of energy independence. In response, the EU has intensified its efforts to develop a robust and diversified supply base for critical raw materials and to accelerate the deployment of renewable energy sources, thereby enhancing its strategic autonomy and resilience in the face of global uncertainties.[82] This strategic expansion of EU climate policy to a more full-fledged green industrial policy is particularly evident in the introduction of the Carbon Border Adjustment Mechanism (CBAM), the Net Zero Industry Act, and the Critical Raw Materials Act. Each is described in greater detail below.

Proposed in July 2021 as part of the 'Fit for 55' package, the CBAM is a pioneering policy instrument designed to prevent carbon leakage by applying a carbon price on imports of certain carbon-intensive goods.[83] It will successively replace free allocation of allowances as the primary safeguard against emissions leakage under the EU ETS. To do so, it extends the carbon price applied under the EU ETS to the emissions associated with imports of six product categories – cement, iron and steel, aluminum, fertilizer, electricity, and hydrogen – based on verified emissions data from foreign producers or default assumptions about the carbon intensity of these goods. From October 2023, importers have been required to declare the emissions embedded in covered goods entering the customs territory of the EU.[84] From 2026, importers will additionally need to purchase and annually surrender certificates in an amount equal to the independently

81 Kathleen R McNamara, 'Transforming Europe? The EU's Industrial Policy and Geopolitical Turn' (2023) Journal of European Public Policy 1.

82 Susanna Paleari, 'The Role of Strategic Autonomy in the EU Green Transition' (2024) 16 Sustainability; Tagliapietra/Veugelers (n 4).

83 Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism [2023] OJ L 130/52.

84 Such declaration entails calculating the emissions released during the production of imported goods and obtaining validation of the emissions declaration by an accredited verifier, which is an independent third party. For goods that are not listed in Annex II of the CBAM Regulation, this obligation also extends to indirect emissions from production of electricity consumed during the production process. European Commission, 'Commission Implementing Regulation (EU) 2023/1773 Laying down the Rules for the Application of Regulation (EU) 2023/956 of the European Parliament

verified and declared emissions from the preceding year, with certificates priced at the same level as EU ETS allowances.[85]

The Net Zero Industry Act, meanwhile, is a legislative initiative aimed at accelerating the EU transition to a net-zero economy by bolstering the development and deployment of clean technologies across key industrial sectors.[86] This Act is part of the broader European Green Deal broader strategy to achieve climate neutrality by 2050, and operationalizes an earlier European Green Deal Industrial Plan focused on enhancing the EU's industrial competitiveness and innovation capacity in the green technology market.[87] The Act outlines a framework for providing targeted support to industries critical to the green transition, including renewable energy, energy storage, and carbon capture and utilization technologies. It proposes a mix of financial incentives, regulatory reforms, and research and development initiatives designed to stimulate investment, reduce bureaucratic hurdles, and foster collaboration between the public and private sectors. The Act also emphasizes the importance of skills development and workforce transition programs to ensure that the workforce is equipped to thrive in the emerging green economy.[88] By focusing on the strategic development of clean industries, the Net Zero Industry Act aims to position the EU as a global leader in green technology, ensuring long-term economic growth and job creation while meeting its ambitious climate targets. As such, it represents a step in aligning the EU's industrial policy with its environmental objectives, and also contributes to a socially just and inclusive transition.

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and of the Council as Regards Reporting Obligations for the Purposes of the Carbon Border Adjustment Mechanism during the Transitional Period' [2023] OJ L 228/94.

85 Initially, the payment obligation will be prorated to reflect the remaining share of allowances allocated for free to EU producers, and gradually increase as free allocation is phased out.

86 Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 Establishing a Framework of Measures for Strengthening Europe's Net-Zero Technology Manufacturing Ecosystem and Amending Regulation (EU) 2018/1724 [2024] OJ L 1735/1.

87 European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions 'A Green Deal Industrial Plan for the Net-Zero Age' COM (2023) 62 final <https://commission.europa.eu/system/files/2023-02/COM_2023_62_2_EN_ACT_A%20Green%20Deal%20Industrial%20Plan%20for%20the%20Net-Zero%20Age.pdf> accessed 17 March 2023.

88 Veugelers/Tagliapietra/Trasi (n 2).

Finally, the Critical Raw Materials Act is a legislative initiative designed to secure the European Union's supply of essential materials crucial for the green transition and digital economy.[89] Recognizing the strategic importance of critical raw materials (CRMs) such as rare earth elements, lithium, and cobalt, the Act aims to reduce European dependency on external sources and mitigate the risks associated with supply chain disruptions.[90] The Act envisions a comprehensive approach to enhancing European resilience with regard to these critical supply chains, including measures to boost domestic production, promote recycling and circular economy practices, and diversify supply chains through strategic partnerships with like-minded countries. It also emphasizes the need for sustainability and responsible sourcing in the extraction and processing of CRMs, addressing environmental and social concerns associated with CRM production. By aiming to secure a sustainable supply of CRMs, the Critical Raw Materials Act supports the EU in its ambitions in clean energy, digitalization, and the defense sector, all of which rely heavily on these materials.[91]

The political and regulatory context of the European Union's green industrial policy evidences a comprehensive and strategic approach to weaving together environmental, economic, and industrial policy strands. Recent political pressures have seen a recalibration of priorities towards greater emphasis on competitiveness and supply security, yet the long term ambition of EU climate policy remains unchanged. This consistent, forward-looking policy framework has helped position the EU as a global leader in green industrial development, and also serves as an important model for other countries seeking to integrate sustainability and economic prosperity in the transition to a green economy.

(c) Assessment

The EU's green industrial policy agenda has begun to reshape the industrial landscape in Europe, although it has yet to drive the desired investment in clean technology manufacturing. Because central initiatives – such as the

89 Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials and Amending Regulations (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1724 and (EU) 2019/1020 [2024] OJ L 2024/1252.

90 Schreurs (n 19).

91 Mertens et al. (n 25).

CBAM, Net Zero Industry Act, and Critical Raw Materials Act – have only recently entered into force, one can only speculate about their expected impacts. Still, the CBAM, for example, signals a bold move towards leveling the global playing field, encouraging producers both within and outside the EU to adopt cleaner production methods.[92] This not only aids in reducing global carbon emissions, but also protects EU industries from unfair competition, thereby supporting jobs and economic growth within the union. The Net Zero Industry Act and Critical Raw Materials Act, moreover, aspire to substantiate the EU commitment to securing its industrial base and supply chains for essential materials.[93] Initiatives envisioned with the more recent Clean Industrial Deal stand to further bolster European competitiveness and industrial decarbonization.

Looking ahead, it is already apparent that EU green industrial policy sets a strategic direction for sustainable growth and competitiveness on the global stage. The emphasis on clean technologies and the transition to a circular economy presents an opportunity for the EU to lead in the creation of new markets and industries. Moreover, by promoting high standards of environmental protection and labor rights, the EU is poised to define global norms and practices for sustainable development in a manifestation of the 'Brussels Effect',[94] a normative diffusion process that is already in evidence with the CBAM spurring adoption of carbon pricing in EU trade partners around the world.[95] The impact of these policies will likely extend far beyond the borders of the EU, setting standards and practices that could inspire similar ambitions worldwide. In doing so, the European Union not only stands to advance greater sustainability at home, but also has an opportunity to demonstrate that industrial decarbonization can occur

92 Kimberly A Clausing/Catherine Wolfram, 'Carbon Border Adjustments, Climate Clubs, and Subsidy Races When Climate Policies Vary' (2023) 37 Journal of Economic Perspectives 137.

93 Oberthür/von Homeyer (n 71); Schreurs (n 18).

94 Anu Bradford, *The Brussels Effect: How the European Union Rules the World* (Oxford University Press 2020) <https://academic.oup.com/book/36491> accessed 26 August 2024.

95 Jos M Delbeke/Peter Vis, 'How CBAM Can Become a Steppingstone towards Carbon Pricing Globally' (European University Institute 2023) <https://cadmus.eui.eu/handle/1814/75472> accessed 26 October 2023 accessed 26 August 2024; Michael A Mehling/Geoffroy Dolphin/Robert A Ritz, 'The European Union's CBAM: Averting Emissions Leakage or Promoting the Diffusion of Carbon Pricing?' (University of Cambridge 2024) <https://www.jbs.cam.ac.uk/wp-content/uploads/2024/10/eprg-wp2416.pdf> accessed 15 July 2025.

alongside economic prosperity and resilience – a message many observers around the world will draw on as a benchmark for the success or failure of green industrial policy.

However, the successful implementation of this ambitious policy framework will require navigating a rapidly evolving political landscape. As the EU emerges from pivotal elections that have shifted political majorities in line with evolving priorities of the electorate, it must navigate complex global dynamics, including trade tensions and the geopolitical implications of the energy transition as well as a widespread trend towards protectionism and fragmented markets. Collaborative approaches, both within the EU and with international partners, will be crucial for advancing shared climate goals and ensuring a just transition for all stakeholders.[96] By embracing a globally oriented perspective and continuously adapting its policy toolkit, the EU can navigate the complexities encountered on the way to a successful green industrial policy strategy. Building on its decade-long journey of increasingly ambitious climate policy, and the more recent thrust of the European Green Deal and Clean Industrial Deal, the EU is equipped like few others to balance the risks and benefits of an industrial policy strategy. Still, that journey will not be easy, and a successful transition is far from guaranteed.

D. Conclusions

The European Union and the United States have each adopted distinct yet impactful green industrial policies. Whereas the U.S. vigorously embraced a green industrial policy strategy during the Biden administration and subsequently abandoned it again, demonstrating the political vulnerability of an approach specifically designed to withstand partisan challenges, Europe has succeeded in sustaining long-term climate policy continuity, but only by reconciling decarbonization objectives with economic and social priorities. Both jurisdictions thus display fundamental differences that are deeply anchored in institutional structures and the political economy on each side of the Atlantic, with the U.S. frequently defining climate policy paradigms, but then unable to sustain implementation due to persistent gridlock and

96 Chad P Bown/Kimberly A Clausing, 'How Trade Cooperation by the United States, the European Union, and China Can Fight Climate Change' (Peterson Institute of International Economics (PIIE) 2023) WP 23–8 <https://www.piie.com/sites/default/files/2023-10/wp23-8.pdf> accessed 26 March 2024.

shifts in leadership; and Europe often a reluctant follower that ends up pursuing these paradigms with continuity and technocratic leadership.

During the Biden administration's deployment of industrial policy, the U.S. chose to focus on fiscal incentives and other public investments in innovation and deployment to spur the growth of a domestic clean energy sector and drive adoption of clean technologies. Through legislative measures such as the IRA, the IIJA and the CHIPS and Science Act, it succeeded in creating a favorable context for investment in renewable energy, infrastructure modernization, and technological advancement, prioritizing economic stimulus and energy security, and leveraging federal support to catalyze industry-wide shifts towards greater decarbonization. Still, a change in political leadership upended this policy approach and stymied the already unfolding transformation, threatening U.S. climate leadership and raising questions about its reliability as a partner in international climate cooperation.

By contrast, EU green industrial policy, spearheaded by the European Green Deal and Clean Industrial Deal, has adopted a systemic approach to sustainability, weaving climate objectives into economic, social, and industrial fabrics. Its many elements, such as the CBAM and the CRMA, demonstrate a commitment to protecting its industrial base, securing supply chains, and growing domestic clean technology manufacturing. In that regard, it is not so different from industrial policy initiatives taken in recent years across the Atlantic, but unlike U.S. approaches it relies heavily on carbon pricing, coupling support measures that lower the cost of abatement with measures that increase the cost of emissions. In other words, the European vision of a carbon-neutral future emphasizes a more balanced deployment of financial incentives and regulatory measures to support a just and inclusive transition.[97]

Despite such differences in approach and starting point, both the EU and the U.S. offer valuable lessons for other jurisdictions looking to rely on green industrial policy to advance a combined environmental, social, and economic policy agenda in a global context of regional fragmentation and increasingly protectionist reflexes. These lessons can be summarized with the following five takeaways:

- *Integrating Sustainability Across Sectors*: The EU approach of embedding climate goals across all policy areas with the European Green Deal and

97 Veugelers/Tagliapietra/Trasi (n 2).

Clean Industrial Deal offers an effective blueprint for systemic change. Jurisdictions can learn from this approach by ensuring that sustainability is not siloed within environmental policy making, but is a central tenet of economic, social, and industrial policies over the long term.

- *Leveraging Fiscal Incentives for Rapid Innovation*: The brief U.S. success in utilizing tax incentives to stimulate clean technology deployment illustrates the power of fiscal policy in accelerating innovation. While the EU cannot replicate this approach given a lack of fiscal powers, other jurisdictions might consider similar incentives to drive investment and adoption of sustainable technologies, particularly in nascent industries.
- *Building Resilient and Diverse Supply Chains*: Both the EU and the U.S. have at different times advanced policy initiatives that set production targets and local content requirements for domestically sourced materials and components, recognizing the importance of secure supply chains for the energy transition. This is a critical step to ensure the resilience of clean energy industries against geopolitical and economic disruptions, yet also has to be balanced against the risks of economic fragmentation and decoupling, as well as protectionist reflexes.
- *Fostering International Collaboration*: The global nature of climate change and the interconnectedness of economies necessitate a collaborative approach to green industrial policy. Learning from EU efforts to project its normative aspirations internationally as well as U.S. initiatives to create partnerships with like-minded nations – for instance through free trade agreements that focus on critical raw materials – other jurisdictions should seek partnerships that advance shared goals, methodologies and practices.
- *Ensuring Equity and Inclusivity*: An essential lesson from both regions is the importance of integrating social equity into green industrial policy. Ensuring that the benefits of the green transition are widely shared, particularly among disadvantaged communities, is crucial for building public support and the necessary workforce for the energy transition. This aspect will become even more crucial as the global economy becomes more competitive, and domestic politics are increasingly encumbered by populist and nationalist movements.

By balancing systemic reforms with targeted incentives, building resilient supply chains, fostering international collaboration, and ensuring equity and inclusivity, jurisdictions can navigate the complexities of the green transition more effectively. Green industrial policy can play a vital role in

advancing these objectives. At the same time, it remains unclear to what extent the potential risks and costs of heavy reliance on industrial policy – such as market distortions and freeriding, but also heightened geopolitical and trade tensions with partners around the world – will manifest themselves and offset some of the beneficial outcomes observed to date. In the end, however, the path forward for global sustainability will require not only innovation and investment but also a shared commitment to an equitable and resilient future.

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