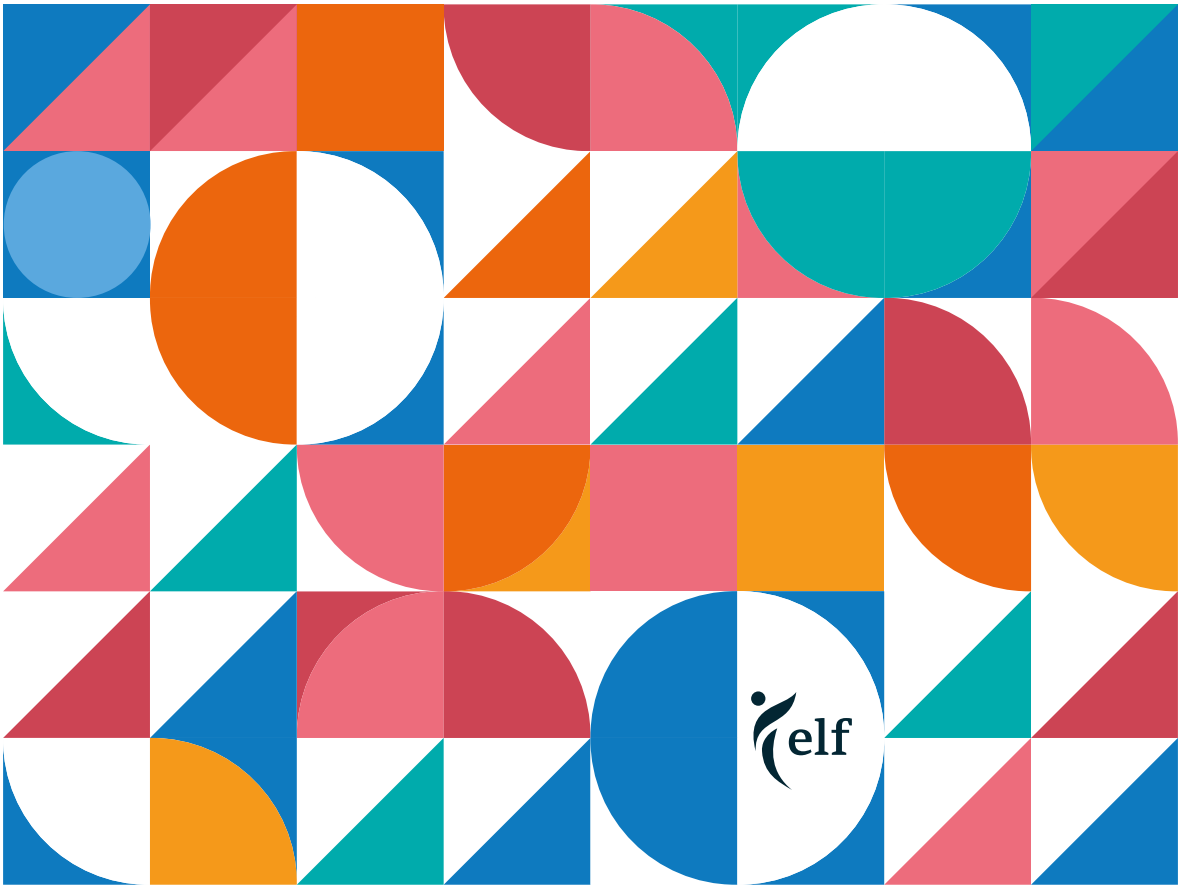
ELF Study 7

Sustainable? Competitive?

The EU's Industrial Autonomy – Facts and Fantasies

Edited by
Francesco Cappelletti
Gerard Pogorel



ELF Study 7

Sustainable? Competitive? The EU's Industrial Autonomy – Facts and Fantasies

Edited by
Francesco Cappelletti
Gérard Pogorel

Published by the European Liberal Forum. Co-funded by the European Parliament.

The European Liberal Forum (ELF) is the official political foundation of the European Liberal Party, the ALDE Party. Together with 59 member organisations, we work all over Europe to bring new ideas into the political debate, to provide a platform for discussion, and to empower citizens to make their voices heard. Our work is guided by liberal ideals and a belief in the principle of freedom. We stand for a future-oriented Europe that offers opportunities for every citizen. ELF is engaged on all political levels, from the local to the European. We bring together a diverse network of national foundations, think tanks and other experts. In this role, our forum serves as a space for an open and informed exchange of views between a wide range of different EU stakeholders.

Page layout: Cheshire Typesetting Ltd, Cuddington, Cheshire
Editors: Francesco Cappelletti, Gérard Pogorel
ISBN: 978-2-39067-066-7
ISSN (print): 2791-3880
ISSN (online): 2791-3899

Contents

Introduction

Gérard Pogorel and Francesco Cappelletti

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABOUT THE AUTHORS

Francesco Cappelletti is Policy and Research Officer at the ELF. Currently a PhD candidate in cybersecurity law at Vrije Universiteit Brussel, he holds an MA in international relations from the University of Florence and an MA in world politics from MGIMO (Moscow). He is a member of the Center for Cybersecurity (Florence) and the Cyber and Data Security Lab (Brussels). He teaches courses related to cybersecurity, diplomacy, and disinformation at the Brussels School of Governance.

Gérard Pogorel is Professor Emeritus of Economics at the Institut Polytechnique de Paris-Telecom, CNRS Interdisciplinary Institute for Innovation. An independent international expert in telecommunications, media, and the digital economy, he has worked with the European Commission, national authorities, and scientific committees.

INTRODUCTION

As the European Union races towards a sustainable future, it faces a complex landscape of sustainability, sovereignty-oriented industrial policy, and international trade and relations challenges. Our climate ambitions should be built on a feasible outlook for a technologically advanced and sustainable future instead of aspiring to a green utopia. Climate targets have shifted away from ideological disputes and now focus on an eco-pragmatic and sensible strategy for cultivating a sustainable and thriving future.

Covering the key topics concerning green sustainability, economic growth, and policy implementation in liberal democracies, this ELF study assesses the relative role of market mechanisms, state intervention, financial incentives, regulation, and the importance of in-depth, real-time, strategy monitoring, and the role of digital technologies. It explores the implications for public institutions and industry relationships, the European social model, and international cooperation and competition. The aim is to offer a comprehensive and multifaceted examination of the EU's journey towards a sustainable future and its complexities. It also aims to provide a preliminary assessment of currently implemented policies at the EU level, in the Member States, and internationally.

The study aims to analyse the EU's broader strategic autonomy issues, particularly in energy production, access to mineral resources, and securing industrial components and value chains. It acknowledges the varied development paths of Member States and stresses the importance of balanced development across the Union. The study concludes with an optimistic outlook on the EU's institutional capacity to achieve sustainable development, emphasising the critical role of digital technologies and artificial intelligence in facilitating this transition.

Ultimately, the study delves into issues relevant to the 2024 European Parliament elections, including

strategic autonomy policies, competition, state aid provisions, budgetary rules, and international relations. Given this endeavour, the editors would like to thank all the authors for their invaluable contributions on these very important topics, and for helping us bridge the gap between academia and policy-makers, making this publication and its recommendations a real 'pocket-sized' guide to sustainable industrial policies in the coming years. In an era marked by rapid environmental and geopolitical shifts, this study provides essential insights into shaping a resilient, sustainable future for the EU.

SUSTAINABILITY, THE EU, AND STRATEGIC AUTONOMY

Green sustainability is the challenge of our time. The sustainable development imperative collides with highly inflammable EU strategic autonomy issues regarding energy production and consumption, production of and access to mineral resources, securing industrial components and value chains, and transitioning towards a more resilient EU industry and trade structure. The coming European elections will be an occasion to debate the issue of sustainable freedom, opening the door to a mandate for collective effort affecting all areas of our economy and industry.

To achieve the decoupling of energy and resource consumption from GDP growth, sustainable growth policies must align with industry strategies and private investment

When addressing the green sustainability imperative in the EU, it is crucial to consider Member States' investment capabilities, tensions between the more versus less indebted, and varied budgetary constraints. Balanced development across the Union is vital to the EU's existence and meaning. However, Member States' development paths in recent decades have varied due to different economic and industrial histories and profiles, different governmental and political colours, doctrines regarding the role of industrial policy and budget rules, and stochastic factors. But it now confronts ever more formidable obstacles. The path to implementing sustainable development involves an in-depth economic, industrial, social, and behavioural transformation, possibly more significant than the internal market, the euro, and fighting the COVID-19 pandemic. The EU has done a remarkable job of smoothing out differences, even if the public would have preferred results to be achieved in days instead of months. In the end, the Union has lived up to and even surpassed its calling, despite the negative warnings of its critics.

Under the current conditions, we can reasonably expect the EU's institutional heft to deliver if provided with accurate information and the appropriate incentives and monitoring tools in place.

INDUSTRY, STRATEGY, ENERGY

To ensure the success of sustainable growth policies, industrial strategy considerations should prioritise relevance, flexibility, and, above all, competitivity. Publicly funded industrial projects must adhere to strategic industry criteria and align with sustainability policies. To achieve the decoupling of energy and resource consumption from GDP growth, sustainable growth policies must align with industry strategies and private investment. The current climate emergency and national initiatives at the international level create a complex and opaque structure. What conditions are necessary for the EU's industrial policies to be successful?

A restructured energy sector and an internationally competitive European industry can be sustainable only if they conform to price and market mechanisms guiding supply and demand. Regulation cannot be a perfect substitute for price mechanisms. It introduces, especially in highly dynamic contexts, distortions in markets and technology evolutions. Policy alignment with sound business strategies require vital cross-stakeholder consultations and initiatives, as initiated by the 'Green Recovery Alliance' in 2020.

There is something troubling in the inflated focus of public debates on the number of financial support programmes. Major attention should be paid to the industry rationale for the funded projects. For example, some chips factories operate successfully in Europe. However, scaling up ('doubling') the overall proportion of chips made in Europe requires an assessment and initiatives regarding manufacturing costs and the availability of skilled manpower to keep overall costs in line with those achieved in the leading country, Taiwan – as opposed to what a documented assessment by the *New York Times* of February 2023 states regarding, in particular, current projects in the US (Liu & Mozur, 2023). The newly published 'guidance document on the

application process for "first-of-a-kind" facilities to request the status of integrated production facility and/or open EU foundry' is an excellent example of industrial initiative by the Commission combining selectivity and proactivity.[1]

The real-time assessment and monitoring of supported projects in such a fast-moving environment is delicate. Building an extra layer of controlling bureaucracy with questionable legitimacy is out of the question. However, economic conditions will continue to undergo constant changes and supported projects might be able to reorient in real time, thus maintaining strategic flexibility.

A major case is European automobiles, an industry where European leadership is challenged. German auto manufacturers have long expressed concern regarding the tectonic shifts in EU–China trade and investments. Coming up with the right strategy is problematic. A particularly striking move has been made by Stellantis, a transatlantic car manufacturer. After cutting all ties with Chinese partners and advocating a level of protection of the European market from Chinese electric vehicle imports, its CEO in October 2023 made a surprise announcement of a 20 per cent investment deal with Leapmotor, a Hangzhou-based e-vehicle start-up founded in 2015, with the dual purpose of learning from its industrial experience and taking charge of its world exports (Stellantis, 2023). Tavares said: 'There was a need to adopt a "global mentality". As we have global issues to face, we have to adopt a global mentality. We do not support a fragmented world. We like competition.' Furthermore, referring to the announced EU inquiry into state subsidies to e-car manufacturers in China, he added: 'To start a probe is not the best way to tackle those questions.'[2]

Unheard-of multidimensional analyses are needed to stay the course for EU objectives, as geographies, technologies, production factors, labour, capital, and knowledge disruptively engage each other.

> Do the objectives of sustainability, sovereignty and reindustrialization indiscriminately justify all-out budgetary efforts on batteries, electric vehicles, hydrogen, offshore wind power … and photovoltaics? The case of this, a quasi-mature technological field in which Chinese industry excels, is not the same as that of electrolysers, a field in which the various competing techniques are expected to make significant progress, where Europeans and in particular the French have significant assets and where the Chinese are (still) far from being dominant. (Finon, 2023)

THE FINANCIAL BONANZA SHOULD WATER A FERTILE (INTERNATIONAL) SOIL

Industrial policies help incentivise strategic sovereignty industries, optimise mobility infrastructure, and encourage efforts to develop clean technologies where they are missing. However, the focus has often been overly concentrated on the quantity of EU funding and comparisons with the United States. Have we devoted sufficient effort to evaluating the soundness of the projects and their alignment with the EU's dynamic comparative advantages in resources and skills?

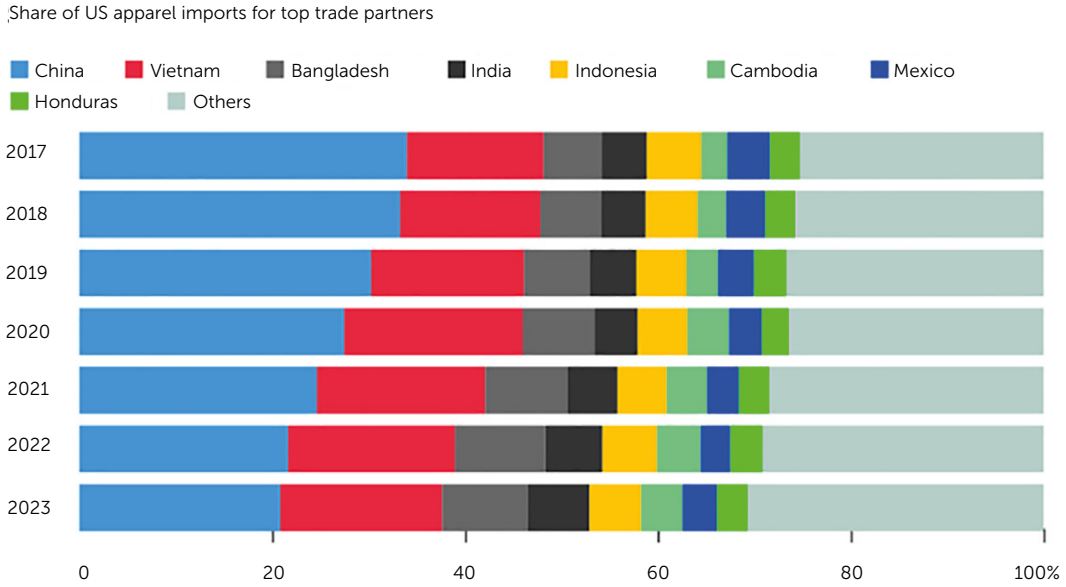
For example, doubts are already being raised in the United States about the outcomes of the combined Infrastructure Law, the CHIPS and Science Act, and the climate-focused Inflation Reduction Act (Meyer, 2023). Similarly, in Europe, with substantial sums in the hundreds of millions of euros at stake, heavily indebted Member States may prioritise windfall gains over supporting well-conceived policies and initiatives. The urgency induced by the race among global industrial powers complicates the task of directing funds to the most suitable companies and projects.

Given this context, sustainability policy objectives should be defined cooperatively and framed within a context of international markets to the greatest extent feasible. Therefore, the importance of maintaining the benefits of an open international economy cannot be overstated.

Such policies will have a profound impact on the structure of EU industries, radically altering competitive relationships between countries and forging a new geography of competitive advantages. The early, intense, and poorly anticipated struggle with the United States exemplifies the complexity of this situation and presents a dilemma: should we respond reciprocally to protectionist measures or seek trade-offs? We should not be blindsided, however, by what is going on in the United States. Valuable lessons and policy inspiration can be gleaned from collaborating with countries such as South Korea and Taiwan, which could introduce greater flexibility in strategic alliances.

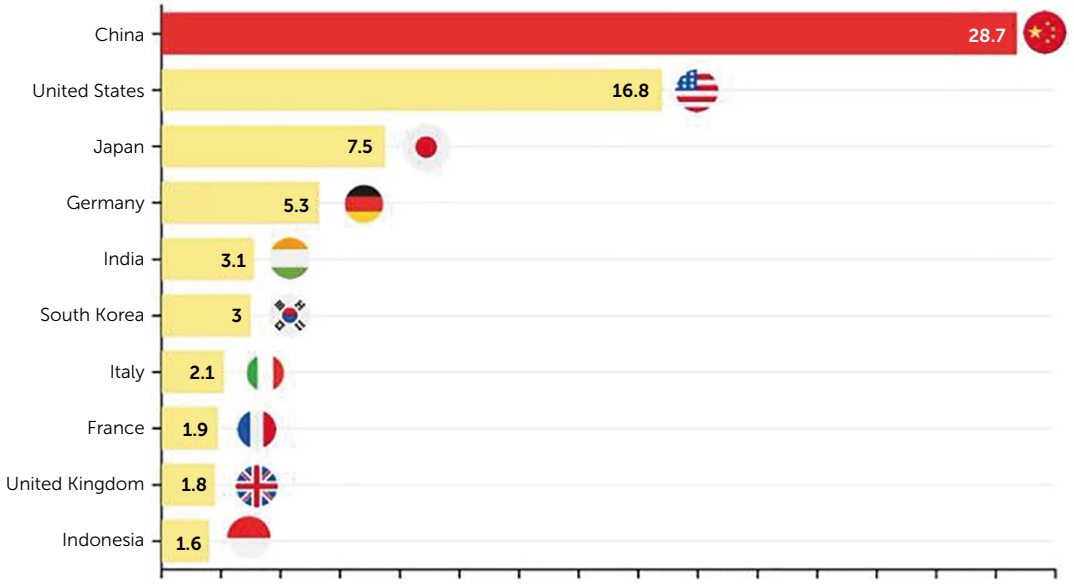
In this context the Chinese rivalry conundrum comes at the cost of industrial autonomy for the EU. For instance, the process of reducing reliance on China, as seen in America's shift in clothing sourcing, illustrates the gradual nature of de-risking efforts (see Figure 1). It took six years to decrease China's share from 35 per cent to 21 per cent, through a combination of diversification and reshoring, resulting in an increase in local production from 25 per cent to 32 per cent (*Financial Times*, 2023).

FIGURE 1: **America is diversifying its clothing sources**



Source: Bloomberg
Note: 2023 data is updated to August

FIGURE 2: **Percentage share of global manufacturing**



Source: *Financial Times* (2023)

Despite these efforts, China still accounted for 28.7 per cent of global manufacturing in 2022, significantly ahead of the United States and the EU (see Figure 2). This underscores the magnitude of the challenge for Europe, in terms of both scale and the need to leverage unique competencies developed over time in various sectors.

According to research by the European Central Bank, 'friend-shoring' is occurring:

> A reshaping of global supply chains is leading to increased consumer and producer prices, especially in trade-intensive manufacturing sectors. This decoupling of supply chains also involves labor reallocation across different skill levels. Consequently, global trade is likely to decrease significantly, fueled by reduced trade in intermediate inputs and countries' increased dependence on domestic production. (Attinasi, Boeckelmann, & Meunier, 2023)

CONCLUSIONS

To achieve the goals of sustainable development while maintaining a competitive industrial edge, policy implementation should align with industry and corporate management rules and practices in addressing the transition towards green sustainability. This includes real-time monitoring of policy alignment, making the necessary adjustments, and being aware of the length and complexity of the transition ahead for the 2024 European elections and beyond.

Some challenges to the industrial sustainability transition remain, including:

- the potential conflict between decarbonisation goals and high-level international relations imperatives (sovereignty);
- the need to harmonise visions of oil and gas's role in the EU's energy mix in the coming years; and
- the difficulty of balancing the influence of digital industries with those benefiting from carbon rents.

Local strife and competition between regions and cities for investment benefits can take time and risks wasting resources. Like the United States' domestic priority of winning back the votes of American blue-collar workers, Europe might face distortions in industrial objectives due to political considerations.

Government actions should primarily incentivise the acceleration of change while maintaining the capability to correct course if necessary. The general framework should focus less on regulatory constraints and more on facilitating industry-driven innovations within high-level policy objectives.

Standard decision-making exploratory methodologies such as Risk vs Uncertainty (Knight, 1921), Game Theory, and 'Portfolio' diversification (Markowitz, 1952) remain essential. They offer comprehensive insights and are critical in standard business strategy analytics.

Addressing 'green fatigue' and staying the course amid radical and conservative currents is an intricate balancing act. The EU must be committed to liberal democracy and a free, open economic environment. This commitment is rooted in the Enlightenment, emphasising personal and societal progress, responsibility, and science-based progress. In this context, authoritative arguments are vital to counter both conservative, fatalist attitudes and radical de-growth.

The massive transformation required for green sustainability will demand real-time analysis and engagement from social, industry, and government actors. Leveraging the resources of the European social model can facilitate job creation, transitions, and skills development, as highlighted in the EU Green Deal.

As a consensus area, green sustainability policy unites all societal actors around a strategic intent with shared benefits. While some argue that skills for the new green industry wave are not significantly different from current ones, this requires verification. A polycentric approach (Ostrom, 1990) should be adopted, as social transitions can be challenging.

Sovereignty and strategic autonomy are not absolute and must be carefully balanced. Decoupling could be costly, affecting purchasing power in Western countries. Progress in de-risking varies across industries, and reasoned wisdom-based bets on China as a rational actor considering its interdependencies are necessary. Ultimately, policies must be evaluated through the lens of the 'industrial autonomy trilemma', balancing security, sustainability, and competitiveness.

In conclusion, the EU's journey towards sustainable development, industrial resiliency, and strategic autonomy is a complex interplay of industrial policy, global competition, and cooperation. Balancing national capabilities and ambitions with international partnerships and market dynamics is key. Only this approach will guide the EU towards a resilient, sustainable future, adapting to global challenges while maintaining its competitive edge. We are convinced that the analysis and ideas contained in the chapters of this study will be of help in guiding European legislators toward successful policies in the coming years.

CHAPTERS AND TOPICS

The chapters of this study present a comprehensive examination of the EU's journey towards sustainable development and industrial sustainability, encompassing diverse perspectives and challenges. The chapters, authored by experts in their respective fields, delve into the intricate relationship between the EU's political commitments, technological advancements, and industrial strategies in

the pursuit of a greener future. This ELF study stands out by integrating in-depth case studies and applying a unique analytical framework to assess the EU's journey towards sustainability.

The first chapter discusses the EU's challenge in balancing security, sustainability, industrial autonomy, and competitiveness amid global volatility. **Gérard Pogorel** and **Francesco Cappelletti** explore the need for rigorous governance, institutional resilience, and international cooperation to foster green investments. The authors propose an integrated policy framework, emphasising the European Parliament's role in overseeing strategic sovereignty and sustainable, competitive industrial development.

Ricardo Silvestre discusses the EU's multifaceted response to the recent critical episodes: the 2008 financial crisis, the 2015 migration crisis, the COVID-19 pandemic, and the 2022 European tension resolutions. Silvestre explores the evolution of the EU's environmental policies and emphasises the significance of the European Green Deal in achieving a competitive, net-zero emissions economy by 2050. The chapter underscores the need for robust political commitment and a strategic framework for sustainable industrial transformation.

Simona Benedettini addresses the EU's revised energy strategy in response to the 2022 energy crisis, focusing on accelerating decarbonisation and enhancing energy independence. Key actions include diversifying gas sources, increasing energy efficiency, and expanding renewable energy, as outlined in the REPowerEU Plan. Benedettini assesses how EU energy investments affect competitiveness, emphasising the need for diverse funding, efficient renewables, and competitive markets to turn transition costs into growth opportunities.

Heather Johnson and **Gabriel Solomon** focus on the role of mobile digital connectivity in carbon reduction, advocating for its integration into the EU's sustainable activities taxonomy. Their analysis highlights in great detail how information and communications technologies can significantly reduce greenhouse gas emissions by 2030, evidenced by a case study in building energy management. They address the challenges and propose solutions for achieving the EU's digital and green transition goals.

Emma Argutyan examines the transformation of the EU's chemical industry towards digital, climate-neutral, and sustainable practices. Argutyan identifies key challenges such as labour shortages and the integration of digital technologies. The chapter suggests solutions, including enhancing the industry's attractiveness, reskilling, and upskilling the workforce, and highlights the European Commission's role in science, technology, engineering, and maths education and employment services.

Cedric Merle analyses the complex relationship between finance, sustainability, and geopolitics in the EU. Merle discusses the geopolitical effects of COVID-19 and Russian aggression on sustainable finance, analysing the EU's shift away from Russian gas and its environmental impact. The chapter argues for the EU's strategic autonomy in industrial policies, proposing a balanced trade and supply chain management approach. Merle emphasises the need for unified sustainability definitions to prevent greenwashing and facilitate cross-border financing. The importance of aligning industrial policies with sustainability and geopolitics is highlighted, advocating for a cohesive policy framework. The chapter concludes with the need for an integrated approach to sustainable finance in fostering the EU's sustainable, autonomous future.

Du Ming focuses on China's approach to renewable energy within the framework of green industrial policy. The chapter examines how China's policy prioritises economic development while addressing climate change and how this impacts the EU–China relationship. He argues that China's progress in renewable energy is mainly due to state-led initiatives, yet this progress is often subordinate to economic goals. This stance has led to China's dominance in green technology, posing significant policy questions for the EU. In response, the EU is expected to enforce trade defence measures against China more stringently and develop its green industrial policy. The chapter emphasises the importance of strategic balance in the evolving geopolitical landscape of renewable energy and its implications for the EU's strategic autonomy and industrial policies.

Alexander Sandkamp analyses the growing interdependence between the EU and China, particularly in the light of geopolitical tensions and trade risks. As a significant EU trading partner, China presents opportunities and vulnerabilities in strategic industry sectors and critical raw materials. The EU is seeking to balance this relationship by shifting from 'decoupling' to 'de-risking', aiming to diversify trade and reduce overreliance on China. The chapter explores the complexities and potential costs of reducing EU–China trade ties, underscoring the need for a careful approach to maintaining a robust, secure economic relationship.

Peter Cowhey proposes to prioritise an EU–US framework to regulate Chinese foreign direct investment (FDI) in green supplies and technologies. Cowhey highlights the need for substantial

investment, productivity, and innovation for a sustainable world economy, emphasising the interdependence of the EU, the United States, and China. It addresses concerns over national security and commercial practices impacting this interdependence. The chapter argues that FDI allows significant interdependence despite trade barriers, suggesting a coordinated Atlantic framework to balance risk, political pressures, and the benefits of interdependence. Cowhey proposes a scenario creating a sustainable economy while managing geopolitical rivalries and security issues.

NOTES

1. https://digital-strategy.ec.europa.eu/en/news/european-chips-act-commission-publishes-guidance-application-process-status-integrated-production?pk_source=ec_newsroom&pk_medium=email&pk_campaign=Shaping%20Europe's%20Digital%20Future.
2. https://www.marketscreener.com/quote/stock/STELLANTIS-N-V-117814143/news/Stellantis-CEO-criticises-EU-anti-subsidy-probe-45153254/.

REFERENCES

Attinasi, M.-G., Boeckelmann, L., & Meunier, B. (2023). 'Friend-Shoring Global Value Chains: A Model-Based Assessment'. *ECB Economic Bulletin*, 2. https://www.ecb.europa.eu/pub/economic-bulletin/focus/2023/html/ecb.ebbox202302_03~d4063f8791.en.html.

Financial Times. (2023). 'Western Companies Take Slow Steps towards China "De-risking"', *Financial Times*, 25 September. https://www.ft.com/content/6e903c40-a024-4299-9025-f358882813bb.

Finon, D. (2023). 'Une industrie du solaire photovoltaïque: quelle chance de réussite?'. *Telos*, 23 October, https://www.telos-eu.com/fr/economie/une-industrie-du-solaire-photovoltaique-quelle-cha.html.

Knight, F. (1921). *Risk, Uncertainty, and Profit.* Boston: Houghton Mifflin, http://www.econlib.org/library/Knight/knRUP.html.

Liu, J., & Mozur, P. (2023). 'Inside Taiwanese Chip Giant, a U.S. Expansion Stokes Tensions'. *New York Times*, 22 February. https://www.nytimes.com/2023/02/22/technology/tsmc-arizona-factory-tensions.html?campaign_id=2&emc=edit_th_20230223&instance_id=85887&nl=todaysheadlines&regi_id=59048838&segment_id=126051&user_id=fe344b9d431508d10e28e4aec980fe6d.

Markowitz, H. (1952). 'Portfolio Selection'. *The Journal of Finance*, 7, 77–91, https://doi.org/10.1111/j.1540-6261.1952.tb01525.x.

Meyer, R. (2023). 'A Huge, Uncharted Experiment on the U.S. Economy Is about to Begin'. *New York Times*, 12 February, https://www.nytimes.com/2023/02/12/opinion/economy-ira-infrastructure-clean-energy.html?campaign_id=2&emc=edit_th_20230213&instance_id=85237&nl=todaysheadlines&regi_id=59048838&segment_id=125177&user_id=fe344b9d431508d10e28e4aec980fe6d.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press. DOI: https://doi.org/10.1017/.

Pogorel, G., Nestoras, A., & Cappelletti, F. (2022). 'Decoding EU Digital Strategic Autonomy: Sectors, Issues, and Partners'. European Liberal Forum, https://www.researchgate.net/publication/361736581.

Stellantis. (2023). 'Stellantis to Become a Strategic Shareholder of Leapmotor with €1.5 Billion Investment and Bolster Leapmotor's Global Electric Vehicle Business'. Press release, 26 October, https://www.media.stellantis.com/em-en/corporate-communications/press/stellantis-to-become-a-strategic-shareholder-of-leapmotor-with-1-5-billion-investment-and-bolster-leapmotor-s-global-electric-vehicle-business.

Revisiting the EU Industrial Autonomy Trilemma

Gérard Pogorel and Francesco Cappelletti

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

In addressing the EU's contemporary challenges, this analysis acknowledges a critical intersection between the imperatives of security, sustainability, and industrial autonomy. The EU undertakes substantial efforts in these domains. The rapidly shifting global context, its considerable volatility, and emerging trends render any immediate assessment of recent policy initiatives premature. However, this dynamic and uncertain landscape underscores the limitations of conventional forecasting and necessitates an ongoing reassessment of the EU's strategic priorities. Central to this discourse is the policy 'trilemma' confronting the Union: the need to simultaneously uphold security, foster sustainability, and maintain the focus on competitiveness. In this sense, industrial autonomy refers to the EU's strategic capacity to reinforce its industrial base and supply chains in key sectors, adapting swiftly to global economic and geopolitical shifts. This chapter explores these issues and proposes coherent changes in approach, all within the framework of an EU policy trilemma focusing on security, sustainability, and competitiveness.

ABOUT THE AUTHORS

Gérard Pogorel is Professor of Economics Emeritus, Telecom Paris and Senior Fellow, ELF.

Francesco Cappelletti is Senior Policy and Research Officer, ELF and Researcher, Vrije Universiteit Brussels.

INTRODUCTION

The EU faces significant security and economic sustainability challenges as the 2024 European Parliament elections approach. Fundamental pillars of Union policies, such as competition policies, state aid provisions, and government restraint in industry interventions, and the strategic projection of the EU, are being questioned and reassessed. This critical re-evaluation presents an opportunity to realign these policies in a manner that addresses both the challenges of achieving industrial autonomy and the imperatives of sustainable development (Pogorel, 2022). The EU's current scenario highlights friction between sustainability and industrial autonomy imperatives, on the one hand, and grassroots industry innovation and competitiveness, on the other. Speaking plainly, the EU must balance environmental goals with maintaining a solid and innovative industry and open competition.

It should be emphasised that 'autonomy', in today's world, can only be partial, relative, and not absolute (Hackenbroich & Dullien, 2022). The availability of natural resources, path dependencies, deeply ingrained distinctive competencies, the benefits of international trade (which has been demonstrated to increase the purchasing power of citizens), and limited funding capacities all form a complex background against which industrial autonomy policies must be carefully selected and implemented. In other words, whether or not there are conditions of economic or political risk that generate uncertainty and competitivity, flaws should be assessed. When we consider 'industrial autonomy', it is with this approach in mind.

Amid these challenges, the EU faces a changing global landscape. The two largest industrial powers, the United States and China, seem to have abandoned explicit reference to free trade. As the world changes rapidly, the EU must decide to what extent it will protect its industries, trade openly, and

respond to international pressures. We have already discussed the rise of digital strategic autonomy (Pogorel, Nestoras, & Cappelletti, 2022), its implications for the EU's industrial policy, and new forms of international cooperation that could redefine traditional trade and industrial relations (EPRS, 2022).

Major international partners are adopting protectionist measures, forcing the Union to make complex choices between maintaining friendships and its open trade stance on the one hand, and engaging in reciprocal tactics on the other. This evolving scenario necessitates extensive analysis and stakeholder consultations to navigate the high-level, conceptual policy issues that are intertwined with the continuously changing technological, industrial, and international environment while preserving the vital role of industry initiatives, implementing public rules and incentives when needed, and avoiding government overreach. This means creating supportive regulations and financial incentives for industries while ensuring the government does not excessively control or limit them.

The EU has made noteworthy progress with its 'green' initiatives, particularly the 'Fit for 55' legislative package, which includes substantial funding for the sustainable transition and regulatory reforms. These initiatives have sparked debates within the EU. Negotiations with global partners and allies in the 'friendship circle' – the United States, United Kingdom, Japan, Australia, South Korea, and Taiwan (EEAS, 2021) – are also needed to coordinate and mitigate potential trade and industry disruptions.

The challenge of green sustainability, particularly in the context of the EU's strategic autonomy, involves addressing energy production and consumption, securing access to mineral resources, and transitioning towards a more resilient EU industry structure and trade (Grohol & Veeh, 2023). This path to sustainable development will require an in-depth economic, industrial, social, and behavioural transformation that is more extensive than that of the internal market, the euro, or the fight against the COVID-19 pandemic.

This complex dynamic sets the stage for extensive discussions on policy and industrial aspects from the perspective of 2024 and beyond.

The volatility of the international context and the daily emergence of new considerations make future-proof forecasting a daunting task. Whatever the difficulties of the 'new normal', mixing market considerations and strategic moves in a somewhat game theory-like context, the competitiveness imperative should be constantly considered on an equal footing with the two other elements of the 'trilemma'. Losing sight of the aim of efficiently and cost-effectively maintaining or building the EU industry's distinctive competitiveness would have a drastic negative effect on the EU economy.

The study explores various issues facing the EU in the light of these evolving situations. It examines common misconceptions, suggests realistic orientations, and proposes changes in approach, all within the framework of an EU policy trilemma and emphasising the indivisible imperatives: security, sustainability, and competitiveness. A baseline for the year 2024 is proposed here for the European Liberal Forum's (ELF) contribution, backed by insights from prominent experts.

TRILEMMA

The EU's challenges regarding industrial autonomy, security, sustainability, and competitiveness are significant and complex (see Figure 1). These issues, including the imperative of strategic sovereignty, will play an essential role in the 2024 European Parliament elections and the 2024–2029 legislature, reflecting the EU's security and economic sustainability considerations. Against this backdrop, Union competition policies, state aid provisions, and budgetary rules are being intensely questioned. Addressing these challenges will require a collective effort. In this context, industrial autonomy entails the Union's ability to independently regulate, produce, and innovate within its industrial sectors while responding to international economic pressures and opportunities.

The EU has taken significant steps towards combining trilemma imperatives. However, much work remains to be done to align sustainability policies, rules and incentives, and industrial strategies to ensure the soundness of funded projects and preserve the advantages of an open international economy, exposing the Union to drastic choices between its open trade orientations and tit-for-tat tactics. This highly complex area requires large-scale analysis and stakeholder consultations to inform decisions and put in place the necessary regulatory framework and incentives where needed while avoiding wasting resources.

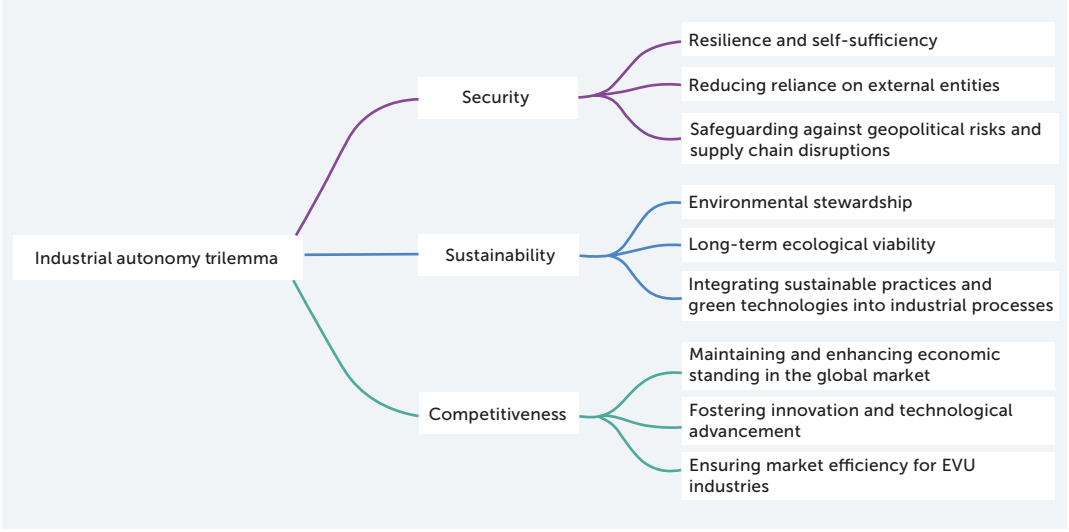
Major background factors to be considered by the EU are the extent of China's tech ambitions and realities on the one side, subject to EU 'wisdom' assessment, and the United States' 'America first' policies on the other, against which the risks and the costs of European industrial autonomy are to be measured while ensuring that competitive, green, and sustainable policies are designed, as much as possible, within an international cooperation framework. The delicate balance between preserving an open global economy and responding to the China rivalry

Industrial autonomy trilemma:
The 'industrial autonomy trilemma' refers to the complex challenge of simultaneously achieving three interrelated and often competing objectives within the EU's industrial policy framework: security, sustainability, and competitiveness.

Security: This aspect emphasises the need for the EU to ensure resilience and self-sufficiency in its industrial sectors, reducing reliance on external entities and safeguarding against geopolitical risks and supply chain disruptions.
Sustainability: This dimension focuses on the commitment to environmental stewardship and long-term ecological viability. It involves integrating sustainable practices and green technologies into industrial processes, aligning with the EU's broader goals of reducing carbon emissions and promoting a green economy.
Competitiveness: This element underscores the importance of maintaining and enhancing the EU's economic standing in the global market. It involves fostering innovation, technological advancement, and market efficiency to ensure that EU industries remain dynamic and competitive on a global scale.

The industrial autonomy trilemma thus represents a strategic balancing act for the EU as it navigates the challenges of securing industrial autonomy without compromising environmental sustainability or global economic competitiveness.

FIGURE 1: **The industrial autonomy trilemma for 2024 and beyond**



Source: Authors' elaboration.

problem while promoting shared views among allies illustrates the intricacies of this task (Di Carlo, 2023). The EU's strategic approach, especially in terms of technology and trade, must be implemented carefully, with the onus on sticking to existing or realistically achievable distinctive competencies.

Policies should state the imperatives, provide fundamental incentives, refer to and rely on sound business practices, use standard exploratory and decision-making methodologies, and take advantage of the resources of the European social model. This includes recognising the need for real-time monitoring of supported projects, maintaining strategic flexibility in the face of changing economic conditions, and avoiding the creation of extra layers of controlling bureaucracy with questionable legitimacy. Despite the heightened complexity and uncertainties of the international environment, due to recent geopolitical shifts and their effects on the energy sector, businesses,

consumers, and the market, Europe's policymakers have shown an ability to cope successfully and swiftly with difficulties.

Digital technologies and artificial intelligence (AI) can help define a sustainable development path, but their carbon footprint must be addressed (see the chapter by Heather Johnson and Gabriel Solomon in this study). The rapid increase in the carbon footprint of digital technologies, growing by 6.7 per cent per year, highlights the urgency of aligning sustainability policies with industrial strategies, especially in sectors such as transport, industry, housing, and energy production (Shen, Yang, & Zhang, 2023).

THE INDUSTRIAL AUTONOMY TRILEMMA TRANSITION PROCESSES

In response to these evolving dynamics, the EU faces critical challenges that require strategic foresight and innovative policy solutions.

1. Given the hard choices and inevitable tensions involved, enhancing the EU's institutional capacity and institutional resilience is crucial for transitioning towards a market-based sustainable economy.
2. The Union must adeptly navigate and manage the dichotomy of radical and conservative forces, ensuring sustainable policy development that balances diverse stakeholder interests and makes possible long-term strategies.
3. Leveraging financial resources to promote green investments and industries is pivotal, including focusing on green financing investment strategies and fostering combined public and industry synergies for sustainable development.
4. Implementing ex ante monitoring will ensure that industrial policy initiatives remain relevant and flexible and contribute significantly to sustainable goals. This necessitates developing sustainability indicators and best practices in project evaluation and adaptive management.
5. The digital transformation, supported by low-carbon technologies and eco-innovation, must be strengthened, especially in counterbalancing carbon-intensive sectors and bolstering sustainable development.
6. Addressing workforce transitions through reskilling and upskilling initiatives is vital to ensure sustainable development within the European social model. This requires real-time analysis and decision-making, underpinned by robust public–private partnerships and multi-stakeholder collaboration.
7. The EU needs to focus on preserving the benefits of an open international economy while decoupling from unsustainable practices. This involves sustainable trade policies and international cooperation to promote the circular economy and enhance resource efficiency and competitiveness within global value chains.

It is essential to implement systems to monitor and guide industrial and sustainable projects from the beginning to ensure their relevance and adaptability to changing conditions while contributing to environmental goals. This requires proactive ex ante monitoring mechanisms to keep industrial initiatives flexible, relevant, and aligned with sustainability objectives. This mechanism implies thinking of a new role for the European Parliament (EP) in both crafting smart policies and monitoring legislation, with the aim of taking into account the feasibility and implementation of the trilemma challenges. This will ensure that investments and policies continuously drive towards the desired outcomes, even as conditions and needs evolve.

Additionally, adopting adaptive industry ecosystems powered by AI and data analytics is now essential to facilitate this process (Vinuesa et al., 2020). These ecosystems use the latest technology and data insights to create a responsive and flexible industrial environment. They can anticipate changes, optimise resource allocation, and facilitate rapid adaptation to new challenges and opportunities. By embracing these adaptive ecosystems, the EU can foster a more resilient and dynamic industrial sector that will maintain competitiveness and sustainability in the face of global shifts and technological advancements. This will require personnel in policy circles to be adequately trained to understand traditional politics and data analytics. Overall, policymakers' job is becoming increasingly difficult.

These approaches represent a shift towards more dynamic and responsive policymaking and industrial strategy. They will ensure that the EU addresses current challenges and is well positioned to capitalise on future opportunities and mitigate emerging risks.

IMPLEMENTING THE STRATEGIC POLICY TRILEMMA

As the EU strives towards these goals while facing an increasingly complex environment, the ELF is staying abreast of current and future developments and contributing actively to policy debates.

The EU has earmarked considerable funds and is undertaking 360° initiatives for the trilemma-inspired transition. An intricate machinery of international relations and negotiations with its major international partners – the United States, United Kingdom, Japan, Australia, New Zealand, South Korea, and Taiwan – is in motion, shaping the EU's

path towards sustainable development and industrial autonomy, and coordinating efforts to avoid significant trade disruptions and harmonise green industry strategies.

In conclusion, the EU's pursuit of security, sustainability, and competitiveness is a trilemma, combining these imperatives in a dynamic and interconnected world. The forthcoming European elections and 2024–2029 legislature will shape the future of these critical policies, reflecting the collective will and effort of all Member States.

CONCLUSIONS: THE ROLE OF THE EUROPEAN PARLIAMENT

As we approach the concluding remarks, it is essential to reflect on the interconnectedness of the themes discussed here, gathering insights and formulating recommendations that resonate with the overarching goal of strategic, sustainable, and competitive EU autonomy. Reflecting on industrial autonomy as defined above, the EU must continuously adapt its strategic approach to ensure a resilient, sustainable, and competitive industrial base (see Figure 2).

Sovereignty and autonomy are complex concepts that cannot be defined in absolute terms. Industrial autonomy involving a complete decoupling from China would be incredibly costly and significantly impact purchasing power in Western countries. However, progress can be made through a 'wisdom-based' assessment to achieve a balance that de-risks and diversifies specific industries. Reasoned bets will need to be placed on China as a rational actor aware of its interdependencies. Standard exploratory and decision-making methodologies are not a magic bullet, but they should not be discarded and can provide insights and help achieve comprehensive and consistent views. Policies must be filtered through the industrial autonomy trilemma of security, sustainability, and competitiveness.

Achieving more industrial self-sufficiency where it is vitally needed while prioritising sustainability in the EU is a complex challenge that requires balancing security, sustainability, and competitiveness. These three elements are critical factors that must be considered when evaluating and shaping the EU's policies and initiatives. Moreover, the elements of the trilemma are not just strategic choices but essential considerations that need to be balanced for the EU's overall growth and stability.

Security ensures that European industries remain resilient and independent, sustainability commits to long-term ecological and economic health, while competitiveness guarantees the EU's dynamic presence in the global economy. These factors are not just strategic choices but necessities for the overall development of the EU. As the Union moves forward, it is essential to integrate these aspects into a comprehensive policy framework.

The EP's role in defining and overseeing regulations that lead to strategic autonomy is integral to achieving smart and sustainable policies in the EU. The EP's engagement is crucial in assessing interactions among authorities, civil society, and industry, exploring innovative regulatory sandboxes, addressing regulatory taxonomy, and investigating stakeholder roles in agile policymaking. As it navigates the trilemma, the EP must ensure that policies are robust, dynamic, and inclusive, contributing to a competitive and resilient European market. By fostering dialogue and collaboration among Member States and stakeholders, the EP upholds its commitment to strategic sovereignty, driving the Union towards a sustainable, competitive, and secure future.

RECOMMENDATIONS

1. Integrated policy framework: Implement an integrated policy approach that harmonises security, sustainability, and competitiveness, ensuring coherent and effective industrial strategy over time within the EU.

2. Sustainable technological advancement: Prioritise and incentivise investments in sustainable and digital technologies, fostering innovation that aligns with green economy goals while enhancing global competitiveness.

3. Strategic international alliances: Strengthen international alliances for synchronised sustainable development efforts and effective management of global trade dynamics.

4. Synchronisation and synergy of public policies and industry strategies: Mobilise resources for research in sustainable industrial practices, emphasising green investments and innovation.

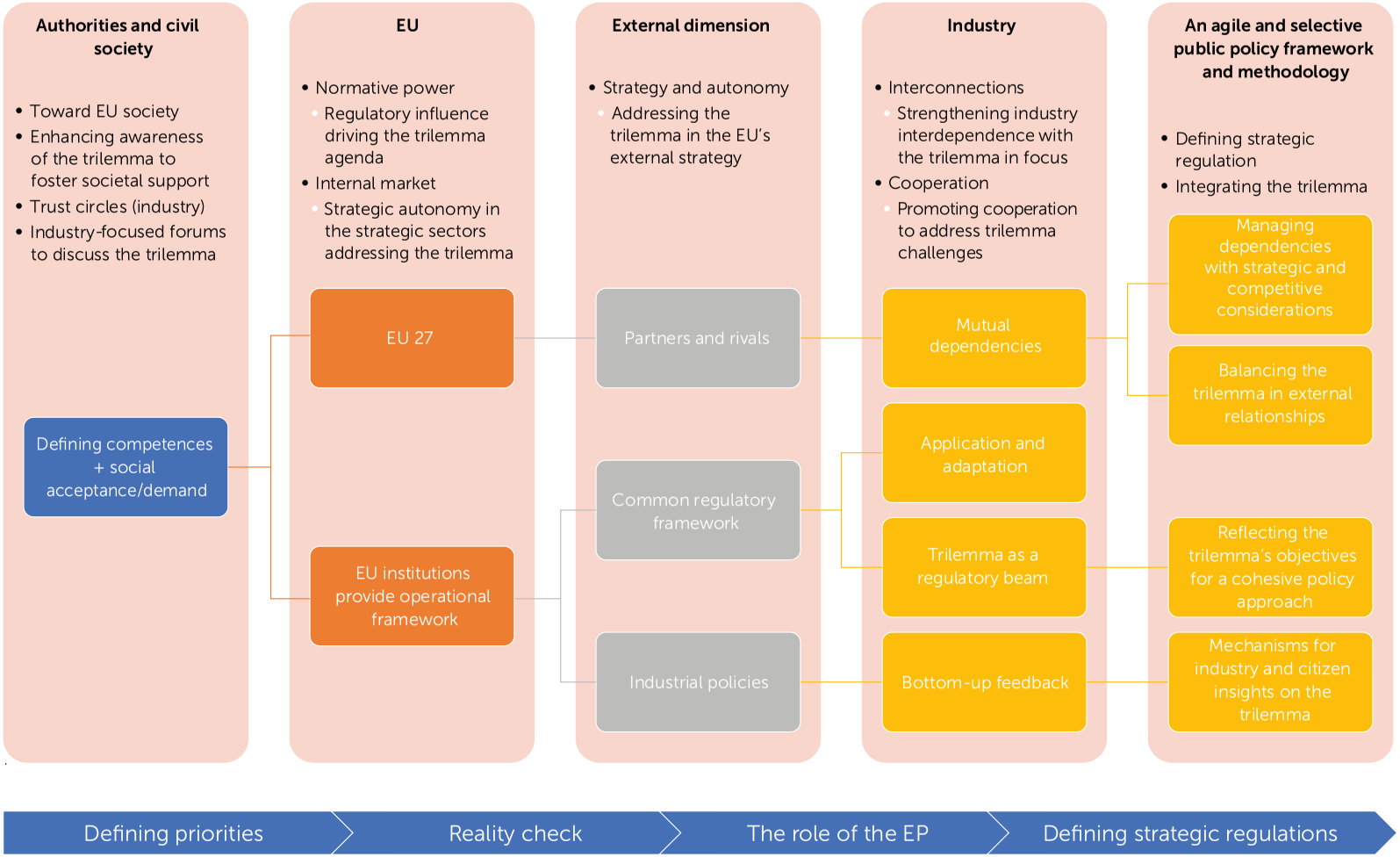
5. Adaptive monitoring mechanisms: Implement dynamic monitoring systems for industrial projects using AI and data analytics, ensuring adaptability to economic shifts and alignment with sustainability objectives.

6. Future-oriented workforce development: Invest significantly in workforce transition strategies focused on skills for emerging green and digital sectors, essential for future labour market demands.

7. Sustainable trade policy design: Craft trade policies that balance industrial autonomy with sustainable practices, reducing reliance on unsustainable resources and practices.

8. Inclusive stakeholder dialogue: Foster inclusive policy development through comprehensive stake-

FIGURE 2: **The EU dimensions of strategic autonomy (updated with trilemma).**



Source: Pogorel et al., 2022.

holder engagement, ensuring diverse perspectives across the EU.

9. Data-driven policymaking: Emphasise the role of real-time data analytics in informing and adapting policy decisions to the evolving global economic and environmental contexts.

10. Renewed role for the EP: The EP of 2024 is in a delicate and important position. A renewed role will enhance its means of monitoring policies (and budgets) with a bottom-up approach that includes industry perspectives. This is imperative given the importance of future regulations for the EU's industry.

REFERENCES

Di Carlo, I. (ed.) (2023). 'EU–China Relations at a Crossroads, Vol. 2: Decoding Complexity, Mitigating Risk'. European Policy Centre. https://www.epc.eu/content/PDF/2023/EU-China_TT_Compendium_2023_Final.pdf.

EEAS (European External Action Service). (2021). 'The European Union and Taiwan: An Overview of the Bilateral Relations between the EU and Taiwan'. Press and Information Team of the Delegation to Taiwan, 26 July. https://www.eeas.europa.eu/delegations/taiwan/european-union-and-taiwan_en?s=242#2849.

EPRS (European Parliament Research Service). (2022). 'Belt and Road Initiative (BRI) and EU–China Relations'. European Parliament Think Tank. https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)733589.

Grohol, M., & Veeh, C. (2023). 'Study on the Critical Raw Materials for the EU 2023 – Final Report'. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (European Commission). European Union Publications Office. https://doi.org/10.2873/725585.

Hackenbroich, J., & Dullien, S. (2022). 'European Industrial Policy: A Crucial Element of Strategic Autonomy'. Foundation for European Progressive Studies, 19 May. https://feps-europe.eu/publication/european-industrial-policy-a-crucial-element-of-strategic-autonomy/.

Pogorel, G. (2022). 'EU Strategic Autonomy: Industry Implications in the Changing World Trade Order'. *Future Europe Journal*, 21 February. https://feu-journal.eu/issues/issue-1/eu-strategic-autonomy-industry-implications-in-the-changing-world-trade-order/.

Pogorel, G., Nestoras, A., & Cappelletti, F. (eds.) (2022). 'Strategic Digital Autonomy'. ELF Techno-Politics Series, Brussels. https://liberalforum.eu/publications/technopolitics/.

Shen, Y., Yang, Z., & Zhang, X. (2023). 'Impact of Digital Technology on Carbon Emissions: Evidence from Chinese Cities'. *Frontiers in Ecology and Evolution*, 11, 1166376. https://doi.org/10.3389/fevo.2023.1166376.

Vinuesa, R., Azizpour, H., Leite, I. et al. (2020). 'The Role of Artificial Intelligence in Achieving the Sustainable Development Goals'. *Nature Communications*, 11, 233. https://doi.org/10.1038/s41467-019-14108-y.

Deals, Acts, and Plans as Engines for a Sustainable Industry in the EU

Ricardo Silvestre

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

The European Green Deal connects to the 'Fit for 55' package, the REPowerEU, and the Circular Economy Action Plan. REPowerEU proposes the Green Deal Industrial Plan, which establishes the Clean Tech EU Platform and the Clean Energy Industry Forum. By itself, the Industrial Plan includes leads to the Net Zero Industry Act. These are some of the instruments to transform the EU into a modern, resource-efficient, and competitive economy. This matrix of packages, acts, and plans may look complicated but careful reading disproves that. It leads the way for protecting the environment, developing industry, accounting for resources, and investing in infrastructure, with a clear view on how to translate vision into action.

ABOUT THE AUTHOR

Ricardo Silvestre is Senior Policy Researcher at the Movimento Liberal Social think tank in Portugal. He holds a PhD in the Philosophy of Science and a master's degree in International Relations. He is an Associate Fellow and host of the Liberal Europe Podcast at the European Liberal Forum, the think tank associated with the Alliance of Liberals and Democrats for Europe Party in the European Parliament. His main areas of interest, and the focus of his published works, are the future of democracy, the energy transition, and the EU security dilemma.

INTRODUCTION

The EU has been dealing with a series of impactful crises, including the 2008 European debt crises, the 2015 migration crises, the 2020 COVID-19 pandemic, and the 2022 return of war to the continent. The effects of these crises can be measured in multiple ways, including politically, socially, economically, and in terms of strategic autonomy. The eurozone crises of 2015, when countries including Cyprus, Greece, Ireland, Portugal, and Spain were incapable of refinancing their state debt or bailing out banks, led to the creation of support measures such as the European Financial Stability Facility and the European Stability Mechanism,[1] while the European Central Bank lowered interest rates and extended more than €1 trillion in loans to maintain the stability of the EU banking system (Trichet, 2009). The migration crises created ideal conditions for the rise of populism in Europe: from the advances of Viktor Orbán in Hungary and Jarosław Kaczyński in Poland, to the growth of the political party Alternative for Germany, to the Leave.EU campaign in the United Kingdom, which influenced the Brexit referendum with the argument that the EU was incapable of controlling its borders. The COVID-19 pandemic caused the EU to take the bold step of issuing European sovereign bonds to support a €750 billion (approved in 2020) fund called NextGenerationEU to support the development of more resilient and modern Member States.[2] The invasion of Ukraine by Russia in February 2022 propelled the EU to become more energy independent and with that to decrease its dependence on unreliable commercial partners, which created a security dilemma (Silvestre, 2023).

These crises need to be seen against a larger backdrop, where there are problems of inflation, the need for social reforms, Member State asymmetries, the need to protect democracy, and the rise of populism

and illiberalism inside the European project. However, another one, possibly more dangerous, has been continuously progressing, demanding for some time now an urgent and complete intervention.

Climate change mitigation is a priority. This is due to the need to preserve the environment, leaving a liveable world for future generations while accounting for the needs of today from a perspective of sustainable growth. This is not a new issue, however, as the EU has been implementing environmental policies since the 1970s, with environmental action programmes now in their eighth edition (up to 2030).[3] Climate and energy legislation was also introduced in the 1990s and later (Oberthür & Homeyer, 2023), including energy efficiency labelling (1992), emissions trading systems (2003), investments in renewable energy (2009), and energy efficiency (2012). However, the 2020s are witnessing more frequent and intense droughts, increased heatwaves accompanied by enormous forest fires, rising sea levels and warming oceans, stronger storms, and massive floods. This influences the ecosystem and all that depends on it, including people and the communities in which they live. In Europe, climate change, depending on the region, has led to biodiversity loss, forest fires, decreasing crop yields, and higher temperatures (European Parliament, 2018).

In 2020, the European Green Deal was approved to transform the EU into a 'modern, resource-efficient and competitive economy'. It also includes the ambitious goal of having no net emissions of greenhouse gases by 2050, decoupling economic growth from resource use, and leaving no one behind (European Commission, 2023a). In 2021, as the COVID-19 pandemic was receding, the 2020 Industrial Strategy was updated to support a twin transition and to make EU industry more competitive globally. The European Commission presented an updated EU Industrial Strategy that included lessons learned from the health crisis response and aimed for a more sustainable, digital, resilient, and forward-looking economy (European Commission, 2023b).

Such bold objectives require a proportional political will and a blueprint for industry transformation. Moving from a carbon-based society for energy and materials to one based on clean energy, where comfort, production, and sustainability are achieved in a sustainable way, is a massive endeavour requiring technological advances and a rethinking of industry – and this in a setting where there is no time to lose. This is a crisis in which the EU cannot afford to wait or apply half-measures for its mitigation. Equally important is the early and repeated engagement of stakeholders in determining what is needed and what direction to take. These stakeholders include political parties, both in the European Parliament and in the Member States, industrial companies, non-governmental organisations working in the field, researchers and developers, and civil society.

The EU needs to account for the costs of modernising subsets of European manufacturing without making it so expensive as to be unrealistic, as well as for the effects it will have on the single market. In this chapter we explore the instruments (acts, plans, and packages) proposed by the EU, how they can place European industry in a position of leadership, and the need to include liberal values.

EU POLICY STRUCTURE

The European Green Deal connects to the 'Fit for 55' package, the REPowerEU, and the Circular Economy Action Plan. REPowerEU proposes the Green Deal Industrial Plan (GDIP), which establishes the Clean Tech EU Platform and the Clean Energy Industry Forum. By itself, the GDIP includes a focus on regulations, leading to the Net Zero Industry Act. Regarding critical materials, this Act leads to the Critical Raw Materials Act; on energy, it links to the Ecodesign Sustainable Products and the EU regulatory framework for batteries; on infrastructure, it ties into the Connecting Europe Facility, the Regulation for the Deployment of Alternative Fuels Infrastructure, and the hydrogen market. In addition, in this industrial plan there is a focus on skills, linking it to the European Pact for Skills and the European Skills Agenda.

This matrix of packages, acts, and plans may look overly complicated, but careful reading disproves that assumption. In fact, the framework of the different ways in which the EU is working to protect the environment, develop industry, account for resources, and invest in infrastructure and in people is easy to follow, and it is clear how it is set up to translate vision into action.

The European Green Deal is easy to summarise. This is the front line in the challenge to adapt the EU to fight climate change, transforming the EU into a 'modern, resource-efficient and competitive economy', with the goals of having no net emissions of greenhouse gases by 2050, encouraging economic growth decoupled from resource use, and leaving no person or place behind (European Commission, 2023b). The European Green Deal then leads to the 'Fit for 55' package, REPowerEU, and Circular Economy Plan.

'Fit for 55' aims to revise and update EU legislation to be in line with climate targets. The main proposal is to increase the contribution of renewable energy

sources in the overall mix by (at least) 40 per cent by 2030 and to increase energy efficiency while reducing final energy consumption by 11.7 per cent by 2030. It also includes initiatives to ensure that EU policies focus on maintaining and strengthening innovation and competitiveness while guaranteeing a level playing field with economic operators in third countries.[4] In addition, it aims to increase funding for the Modernisation Fund and the Innovation Fund (European Commission, 2023c).[5] Some of the measures presented are worth mentioning specifically, for example, the proposal for a progressive, EU-wide reduction in emissions from automobiles, including a 100 per cent reduction of said emission in cars and vans, by 2035. Regarding aviation and maritime transport, 'Fit for 55' proposes the transition in this sector to advanced biofuels and electrofuels and a reduction in greenhouse gas intensity in on-board ship energy of up to 75 per cent by 2050. It also seeks to increase the utilisation of other, greener fuels. This then ties in to one of the important long-term goals of the package: the proposal of rules for a common internal market and infrastructure for hydrogen, which I have discussed elsewhere (Silvestre, 2021). In summary, it is expected that this source of energy, given that there are different types of hydrogen (green, blue, grey, blue, pink, and yellow, depending on the amount of carbon produced), will play a major role in the decarbonisation of industrial sectors that are hard to decarbonise, where alternatives are more polluting and expensive. Hydrogen, preferably of the green (non-polluting) kind, can be used to replace fossil-based transport and industrial processes and to start new industrial products such as green fertilisers and steel. It may also be an option for maritime and aerial transport (European Commission, 2023d). Finally, it should be mentioned that some of the most important beneficiaries of the 'Fit for 55' package are people and businesses in a vulnerable position, ranging from households to microenterprises and transport users.

The REPowerEU plan was a response to external factors, particularly the unprovoked attack on Ukraine by the Russian Federation and the subsequent need to decrease energy purchases from and dependence on Moscow, but it also accelerated an energy transition that was already underway in Europe. The plan materialises objectives of investing in the production of clean energy in a way for doubling the existing share of renewable energy in the EU via 'massive investments in renewable energy' (European Commission, 2023e). The goal is to increase energy production and energy capture, reaching 41 gigawatts (GW) of solar energy and wind capacity of 16 GW. It is also important to mention that funding of the plan comes from the Recovery and Resilience Facility (European Commission, 2023f), including €72 billion in grants and €225 billion in loans, with 95 per cent of the financing dedicated to scaling up the clean energy transition.

The Circular Economy Action Plan (European Commission, 2023g) aims to promote the design of more sustainable products to reduce waste, with a focus on resource-intensive sectors (electronics and in-circuit testing, plastics, textiles, and construction). The package of measures proposed by the European Commission in 2022 (European Commission, 2022a) includes boosting the production of sustainable products, reviewing construction product regulations, creating a strategy for sustainable textiles, and reducing packaging waste with the inclusion of bio-based, biodegradable, and compostable plastics (European Commission, 2022b).

However, the GDIP is the main instrument presented by the European Commission to overhaul the way industry needs to position itself in this green revolution. It aims to play to the EU's strengths: openness, innovation, inclusiveness, and sustainability. It states that, 'with the right conditions, the net-zero industry in Europe will play a vital role in transforming the continent into a green economy – delivering prosperity in the EU and leading globally both on technology and on combatting climate change and environmental pollution' (European Commission, 2023h). This plan includes five structural points: a focus on smart regulations, the assurance of access to critical materials, the management of energy, investment in infrastructure, and a focus on developing skills.

The Net Zero Industry Act may be the best example of how the GDIP reflects the need for the EU to update, create, and test regulations that affect the industrial sector. This net-zero act aims to create 'predictable and simplified regulations' and investments in the production capacity of key products, including the components and equipment needed for manufacturing net-zero technologies (European Commission, 2023i). Technically, projects that include readiness level of technology, decarbonisation and competitiveness, and resilience of energy systems, may be granted priority status. Some of the technologies included in the criteria applied to such projects include solar photovoltaic and thermal; onshore and offshore; battery and storage; heat pumps and geothermal; electrolysers and fuel cells; sustainable biogas/biomethane; carbon capture and storage solutions; and grid technologies (European Commission, 2023i).

The Act also aims to lower the administrative burden for net-zero manufacturing via the streamlining of administrative requirements and permit facilitation. Moreover, it seeks to increase access to markets via public procurement procedures and auctions and to support demand from consumers. Finally, it envisions increasing the competency of the workforce by enhancing skills for net-zero industry through Net-Zero Academies and by improving the portability of qualifications in related and regulated professions.

As for critical materials, the European Critical Raw Materials Act complements the GDIP by creating the conditions to access secure, diversified, affordable, and sustainable critical raw materials for the single market while focusing on the EU's external partnerships (European Commission, 2023j). It identifies a list of strategic raw materials crucial to Europe's green and digital transitions and for defence and space applications. Regarding energy usage and storage, examples of EU initiatives include the Ecodesign Sustainable Products and the EU regulatory framework for batteries. The former was proposed by the European Commission and the latter by the European Parliament. The ecodesign regulation aims for the production of more environmentally sustainable products by establishing requirements for product durability, reusability, upgradability, and repairability; recycling content and remanufacturing; and increasing energy and resource efficiency while decreasing carbon and environmental footprints. It also proposes the introduction of a Digital Product Passport (European Commission, 2023k).

There is a focus on increasing youth employment in green industry

The regulatory framework for batteries is intended to modernise EU regulations on this crucial option for energy storage. This followed a European Commission proposal to modernise the EU's regulatory framework for more sustainable battery value chains. The European Parliament extended the initial proposal by introducing mandatory requirements for sustainability, including carbon footprint rules, minimum recycled content, performance and durability criteria, and requirements for end-of-life management (European Parliament, 2023).

In the important area of infrastructure investment, the GDIP focuses on two transnational European networks, transport (TEN-T) and energy (TEN-E). Three instruments are worth mentioning: the Connecting Europe Facility, the Regulation for the Deployment of Alternative Fuels Infrastructure, and the creation of a European hydrogen market. The Connecting Europe Facility is a funding instrument designed to enable EU decarbonisation goals for 2030 and 2050 via the development of 'high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy, and digital services' (European Commission, 2023l). Regarding the alternative fuel infrastructure, already included in the European Green Deal, it sets mandatory deployment targets for electric recharging and hydrogen refuelling. These include accessible recharging infrastructure and a set of recharging stations in the TEN-T for cars and vans, but also for heavy-duty vehicles, from 2025 onward. Maritime ports and airports are also referenced in this regulatory document: in the maritime domain, the focus is on the need for shoreside electricity for large passenger vessels and 100 port calls ready for container vessels; in the case of airports, it is on the provision of electricity to stationary planes at gates by 2025, and at all remote stands by 2030 (European Commission, 2023m). It is also worth mentioning plans to create an EU hydrogen market, already described in the 'Fit for 55' package. The objective is to deploy hydrogen refuelling infrastructure to serve both cars and trucks from 2030 onwards. This will create a sufficiently dense network to allow hydrogen vehicles to be able to refuel every 200 kilometres along the TEN-T (European Commission, 2023m).

It is equally important to enhance the skills of the labour force so that industry has qualified workers for the green transformation. The GDIP includes the European Pact for Skills for private and public investment to upsource and reskill workers. The Pact for Skills calls for 'national, regional and local authorities; companies; social partners; cross-industry and sectoral organisations; chambers of commerce; education and training providers; and employment services to work together and make a clear commitment to invest in training for all people of working age in the EU' (European Commission, 2023n). There is also the European Skills Agenda, which includes a five-year plan for the development of skills for a twin transition that links to the European Digital Strategy (European Commission, 2023o), the Industrial and Small and Medium Enterprise Strategy (European Commission, 2023p), and the Recovery Plan for Europe (European Commission, 2023q). Importantly, there is also a focus on increasing youth employment in green industry.

The structure presented above is a proposed solution for a multitude of green industrial initiatives taken at the Member State level. A centralised view is needed to account for the differences between EU countries which, if left unchecked, could lead to fragmentation of the single market. This would make it more difficult for companies that invest in clean energy to scale up and compete in international markets. These interlinked solutions will allow for the creation of solid regulations, the promotion of competition, and the creation of a robust single market with environmental and sustainability standards. This will allow companies to internalise externalities, use synergies, and develop economies of scale (Tagliapietra & Veugelers, 2020).

Unsurprisingly, there are overlaps in this lattice of deals, acts, and plans which, in a way, are directed towards the same objective and to achieve similar outcomes. This requires feedback mechanisms from stakeholders to lawmakers and regulators, as implementation takes place, to eliminate redundancies and streamline processes.

THE NEED TO GO GLOBAL

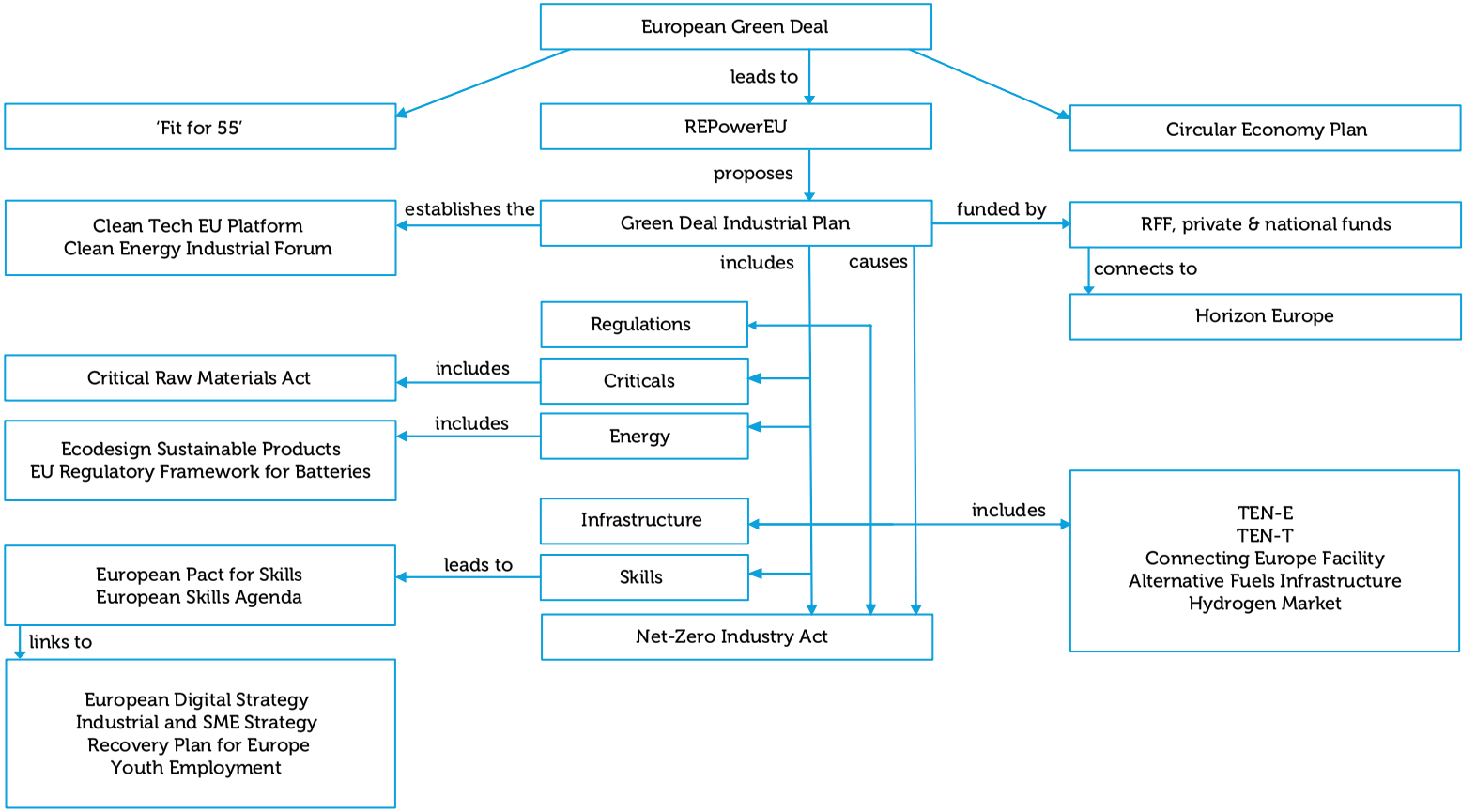
To produce a tangible, universal environmental effect, the EU needs to go global. This includes building partnerships with developed and developing countries. The EU should be at the forefront of the fight against climate change and environmental degradation worldwide. The European Investment Bank (EIB), with its Climate Bank Roadmap (European Investment Bank, 2023), aims to apply 35 per cent of its investments in developing countries, with increased funding for adaptation to climate change, unlocking private capital, minimising emissions, and improving resilience in the face of climate uncertainties (European Investment Bank, 2015). There is a proposal for the creation of a European Climate and Sustainable Development Bank that could serve as a vehicle to expand the European Green Deal to other parts of the globe and amplify EU green industrial policies. Equally, there should be a more concerted coordination between financial institutions, like the European Bank for Reconstruction and Development, and the external activity of the EIB, in such a way that increases the impact of the European development financial architecture at the global level (Council of the European Union, 2019). This would allow for EU green industries to access growing markets and assist in the economic development of EU partner countries (European Investment Bank, 2023). On the industry side, there is a reluctance to invest large amounts of capital in research and innovation, both due to the uncertainty of market penetration and because of spillover effects. Spending on green technologies carries a risk of slow progress and difficulty in upscaling. This is exacerbated by the fact that green technology seems to be more complex than the alternative (Barbieri, Marzucchi, & Rizzo, 2020).

These considerations make the case for a strong EU governance system to successfully implement green industrial policies. There is a need to coordinate between stakeholders, locally and internationally, and to maintain a focus on infrastructure, skills, resources, instruments, projects, and smart regulations while implementing a layer of subsidiarity and including the private sector. This will require EU organisations to be mission driven and Member States' governance to be capable of resisting political and societal pressures. In addition, quantifiable objectives should be established in order to maintain continuous control of processes and apply alterations if and when needed.

Such a transformational change at the political, societal, and industrial level will place the EU in a leading role globally in terms of investment and the application of innovation for technological solutions, driving other blocs to adapt. The oftenmentioned Brussels effect (Bradford, 2020) makes the argument that the EU has the benefit of leaning on the common market, with its size and reach, to garner global regulatory power. In fact, the effect is so considerable that US government structures and industry have started to ask for a seat at the table as Europeans think about regulation, production, and market functioning so they can prepare their own industry to adapt to EU conditions for single market access.

The successful application of the deals, acts, and plans described in this chapter will put the EU on the path to lead a worldwide green transformation, or at least to compete with other blocs. This is vital, as the success of the United States' Green New Deal, or the Inflation Reduction Act (IRA), is highly dependent on the political equilibrium in the two chambers of Congress and the presence of a Republican or a Democrat in the White House. Still, some of the plans and acts presented above have been implemented as a response to the IRA (Scheinert, 2023). The Green Industrial Deal, the relaxing of state aid rules, and proposals such as the Net Zero Industry Act and the Critical Raw Materials Act are some examples. Importantly, fears that significant IRA tax breaks and subsidies for important industries such as electric cars, wind farms, and battery production might cause a hollowing out of the EU economy have not materialised (Jack et al., 2023). This is seen in the markets for solar panels, wind farms, electrolysers for hydrogen production,

FIGURE 1: **EU policy structure**



Source: Author's elaboration

heat pumps, and electric vehicles, where EU industry has proven resilient to the effects of the IRA. The one area where some advantage is seen is in battery production, where the IRA has caused a significant acceleration of projects in the United States, putting it at the same level as the EU, with a battery cell production pipeline of 1,017 GW hours (GWh) while the EU has 1,005 GWh (Jack et al., 2023).

There is a need to counterbalance China's industry dominance in solar, offshore wind, electric vehicles, and hydrogen electrolysers. It is not reasonable to think that it will be possible to sideline China from clean energy supply chains in the near future, but it is 'possible to increase the number of complementary supply chains designed around national security imperatives' (Inevitable Policy Response, 2023).

Such a transformative change in the EU to achieve the decarbonisation of industry requires the inclusion of liberal values. This means involving the private sector and creating public–private partnerships. Some successful examples can be found at the Member State level, for example in Sweden with the Fossil Free Sweden initiative,[6] and in Denmark with the Regeringens klimapartnerskaber,[7] but also at the EU level, including the Clean Hydrogen Joint Undertaking,[8] the Clean Sky 2 Joint Undertaking,[9] the Advisory Council for Aviation Research and Innovation in Europe,[10] the European Green Vehicle Initiative,[11] and the Factories of the Future partnership.[12]

The attribution of public funds should be determined based on merit and in a transparent way. The 'no one left behind' policy should be fully executed, meaning the green transformation is good for the environment but also improves citizens' quality of life and the capacity of the labour force. This could be done through reskilling and upskilling, but also with other mechanisms such as the Just Transition Fund (European Commission, 2023r). When considering, for example, the need for raw materials or the implementation of a circular economy, the liberal principle of taking care of our habitat and leaving a better world for future generations applies. Equally important is having a positive effect on third countries where economic connections are made, guaranteeing that the rules of the game for doing business with the EU, or adapting industry to meet European standards and regulations, include respect for human rights and environmental sustainability.

CONCLUSIONS

If just one argument could be used to explain the urgency of the need to accelerate the EU's green transition to the political class, civil society, and industry, from a budgetary point of view, it is the fact that the longer we take to make those changes, the more difficult it will be to recover from the damage done, and the more expensive it will be to pay for it. From a more holistic perspective, there is a vital need to protect the environment, flora, fauna, and the future of humankind on the planet. A 2022 study suggested that the cost of overhauling infrastructure to achieve 100 per cent renewable energy use would have a price tag of around $62 trillion. However, the authors of the study noted that this switch would generate savings of around $11 trillion per year, meaning the investment would be paid off in six years (Jacobson et al., 2022).

EU green industrial policies need to address the transformative changes that are needed, ranging from climate change policies to building coalitions in specific sectors and industries. This includes a broad set of stakeholders from different parts of industry in a non-zero-sum logic, and with the promotion of public–private partnerships, avoiding political capture and tentativeness, and resisting lobbying pressure from the polluters. Roadmaps need to have vertical components (focus on clean technologies, such as batteries or hydrogen) and horizontal ones (what are the best instruments to use, such as carbon prices, regulations, research subsidies) (European Investment Bank, 2023). An investment in clean technologies needs to account for spillovers for other non-selected clean technologies, requiring a good mix between vertical and horizontal components, financial support with sunset clauses, maintaining fair competition, and avoiding monopolies.

Green industrial policy should be open to experimentation, and policies, regulations, and investments should reflect that. These experiments should, however, have clear and close monitoring and evaluation such that unsuccessful experiments are abandoned or restructured in good time. Experimentation can range from niche projects such as biogas on farms in the Netherlands (Geels & Raven, 2006), grassroots experiments such as transition towns (Seyfang & Haxeltine, 2012), or socio-technical ones such as renewable energy communities (Benedettini, 2023: 14). They might also include sustainability experiments, such as in hydrogen (European Commission, 2023d) or biofuel (Jeswani, Chilvers, & Azapagic, 2020); transition experiments, such as the European Urban Initiative (Kelemen, 2020); or climate governance, such as Net-Zero Cities.[13]

Financing should also cover projects with the aim of accelerating or consolidating existing industrial capabilities, including research, development, and

diffusion; manufacturing; and distribution. In the EU, industrial policy is a Member State responsibility, even if closely supervised centrally with state aid mechanisms and by the competition policy watchdog (European Union, 2023). However, the Green New Deal and the GDIP provide an opportunity to explore a more federalised approach, in line with other recent crisis responses, that includes more centralised decision-making and control of operations.[14] The acceleration of innovation, the creation of regulatory sandboxes, and the distribution of funds for investment could be better managed with a coherent and unified green industrial policy. A level playing field needs to be put in place and enforced with vigour.

On 1 February 2023, President of the European Commission Ursula von der Leyen stated: 'We have a once in a generation opportunity to show the way with speed, ambition and a sense of purpose to secure the EU's industrial lead in the fast-growing net-zero technology sector.' Von der Leyen thus set the goal for Europe to 'lead the clean tech revolution', including that 'for companies and people, it means turning skills into quality jobs, and innovation into mass production'. The challenge is to create a 'simpler and faster framework … better access to finance will allow our key clean tech industries to scale up quickly' (European Commission, 2023s). There is, however, a need for leadership that comes from the top, including the European Commission, the European Parliament, and EU financial institutions. This leadership should materialise in law-making that is adapted to the needs at hand and the implementation and evaluation of the deals, acts, and plans in a way that improves their effectiveness. This leadership also applies to other matters, such as establishing an effective environmental diplomacy. The industrial sector needs to play an active role as a stakeholder in the transition process, with regular reporting of what work is being done and what is needed to make that work easier.[15] At the same time, citizens also need to do their part by organising locally, acting regionally, thinking internationally, and electing politicians nationally and to the European Parliament who understand the problem and how to solve it. The road ahead is clear, and there is no time to lose.

NOTES

1. https://www.esm.europa.eu/about-us/efsf/before-the-esm; https://www.esm.europa.eu/.
2. https://next-generation-eu.europa.eu/index_en.
3. https://wecoop.eu/regional-knowledge-centre/eu-policies-regulations/.
4. https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/.
5. https://modernisationfund.eu/.
6. https://fossilfrittsverige.se/en/about-us/.
7. https://en.kefm.dk/.
8. https://european-union.europa.eu/institutions-law-budget/institutions-and-bodies/search-all-eu-institutions-and-bodies/clean-hydrogen-joint-undertaking_en.
9. https://www.clean-aviation.eu/.
10. https://www.acare4europe.org/.
11. https://www.2zeroemission.eu/.
12. https://www.effra.eu/factories-future.
13. https://netzerocities.eu/.
14. The COVID-19 response and the support to Ukraine in time of war against the Russian invasion are examples.
15. https://ert.eu/documents/cop28/.

REFERENCES

Barbieri, N., Marzucchi, A., & Rizzo, U. (2020). 'Knowledge Sources and Impacts on Subsequent Inventions: Do Green Technologies Differ from Non-Green Ones?'. *Research Policy*, 49(2), 103901.

Benedettini, S. (2023). 'Introduction to *RECs: A Comparative Study Towards the EU Green Deal*'. In R. Gravina (ed), *RECs: A Comparative Study Towards the EU Green Deal*, pp. 14–17. Brussels: European Liberal Forum and Fondazione Luigi Einaudi.

Bradford, A. (2020). *The Brussels Effect: How the European Union Rules the World*. New York: Oxford University Press.

Council of the European Union. (2019). 'Europe in the World: The Future of the European Financial Architecture for Development', October, https://www.consilium.europa.eu/media/40967/efad-report_final.pdf, pp. 29–34.

European Commission. (2022a). 'Green Deal: New Proposals to Make Sustainable Products the Norm and Boost Europe's Resource Independence', Press release, 30 March, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2013.

European Commission. (2022b). 'European Green Deal: Putting an End to Wasteful Packaging, Posting Reuse and Recycling', Press release, 30 November, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7155?fbclid=IwAR17DTjpv2Z22Wf8tQ73xYvoQ7yjuvXVeT8kZhrYDEri9eMkrz4XJrS-eAA.

European Commission. (2023a). 'The European Green Deal', https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

European Commission. (2023b). 'European Industrial Strategy', https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en.

European Commission. (2023c). 'Innovation Fund', https://cinea.ec.europa.eu/programmes/innovation-fund_en.

European Commission. (2023d). 'Hydrogen', https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en.

European Commission. (2023e). 'REPowerEU', https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en.

European Commission. (2023f). 'The Recovery and Resilience Facility', https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en.

European Commission. (2023g). 'Circular Economy Action Plan', https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en.

European Commission. (2023h). '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', 1 February, Press release, 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.

European Commission. (2023i). 'The Net-Zero Industry Act: Accelerating the Transition to Climate Neutrality', https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en.
European Commission. (2023j). 'Critical Raw Materials Act', https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en.
European Commission. (2023k). 'Ecodesign for Sustainable Products Regulation', https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en.
European Commission. (2023l). 'About the Connecting Europe Facility', https://cinea.ec.europa.eu/programmes/connecting-europe-facility/about-connecting-europe-facility_en.
European Commission. (2023m). 'European Green Deal: Ambitious New Law Agreed to Deploy Sufficient Alternative Fuels Infrastructure', European Commission news article, 28 March, https://alternative-fuels-observatory.ec.europa.eu/general-information/news/european-green-deal-ambitious-new-law-agreed-deploy-sufficient-alternative.
European Commission. (2023n). 'About the Pact for Skills', https://pact-for-skills.ec.europa.eu/about_en.
European Commission. (2023o). 'European Commission Digital Strategy', https://commission.europa.eu/publications/european-commission-digital-strategy_en.
European Commission. (2023p). 'SME Strategy', https://single-market-economy.ec.europa.eu/smes/sme-strategy_en.
European Commission. (2023q). 'Recovery Plan for Europe', https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_en.
European Commission. (2023r). 'Just Transition Fund. About the Fund', https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/just-transition-fund_en.
European Commission. (2023s). 'The Green Industrial Plan: Putting Europe's Net-Zero Industry in the Lead', Press release, 1 February, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510.
European Investment Bank. (2015). 'EIB Sets New 35% Target for Climate Lending in Developing Countries', EIB, 9 October, https://www.eib.org/en/press/all/2015-223-eib-sets-new-35pct-target-for-climate-lending-in-developing-countries.html.
European Investment Bank. (2023). 'Climate Bank Roadmap', EIB, https://www.eib.org/en/about/priorities/climate-action/cbr/index.
European Parliament. (2018). 'EU Measures against Climate Change', European Parliament News, August 2018, https://www.europarl.europa.eu/news/en/headlines/society/20180703STO07129/eu-measures-against-climate-change.
European Parliament. (2023). 'New EU Regulatory Framework for Batteries: Setting Sustainability Requirements', European Parliament Think Tank briefing, 8 June, https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)689337.
European Union. (2023). 'Competition: Preserving and Promoting Fair Competition Practice', https://european-union.europa.eu/priorities-and-actions/actions-topic/competition_en.
Geels, F., & Raven, R. (2006). 'Non-Linearity and Expectations in Niche-Development Trajectories: Ups and Downs in Dutch Biogas Development (1973–2003)'. *Technology Analysis & Strategic Management*, 18(3–4), 375–392, https://doi.org/10.1080/09537320600777143.
Inevitable Policy Response. (2023). 'Race to the Top of Clean Energy: The US and EU Responses to China's Dominance', Kaya Partners, January, https://www.unpri.org/download?ac=17824.
Jack, V., Di Sario, F., MacKenzie, L., & Coi, G. (2023). 'EU Shrugs Off Threat from US Inflation Reduction Act — for Now', *Politico Europe*, 24 August, https://www.politico.eu/article/eu-united-states-inflation-reduction-act-subsidies-investment-threat-data/.
Jacobson, M. Z. et al. (2022). 'Low-Cost Solutions to Global Warming, Air Pollution, and Energy Insecurity for 145 Countries'. *Energy & Environmental Science*, 15, 3343.
Jeswani, H., Chilvers, A., & Azapagic, A. (2020). 'Environmental Sustainability of Biofuels: A Review', *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 476(2243), https://doi.org/10.1098/rspa.2020.0351.
Kelemen, A. (2020). 'Supporting Sustainability Transitions under the European Green Deal with Cohesion Policy', European Commission, November, https://eurocid.mne.gov.pt/sites/default/files/repository/paragraph/documents/9193/reportsusttransiten.pdf.
Oberthür, S., & von Homeyer, I. (2023). 'From Emissions Trading to the European Green Deal: The Evolution of the Climate Policy Mix and Climate Policy Integration in the EU'. *Journal of European Public Policy*, 30(3), 445–468, https://doi.org/10.1080/13501763.2022.2120528.
Scheinert, C. (2023). 'EU's Response to the US Inflation Reduction Act (IRA)', Directorate-General for Internal Policies, European Parliament, June, https://www.europarl.europa.eu/RegData/etudes/IDAN/2023/740087/IPOL_IDA(2023)740087_EN.pdf.
Seyfang, G., & Haxeltine, A. (2012). 'Growing Grassroots Innovations: Exploring the Role of Community-Based Initiatives in Governing Sustainable Energy Transitions'. *Environment and Planning C Government and Policy*, 30, 381–400, https://doi.org/10.1068/c10222.
Silvestre, R. (2021). 'Clean Hydrogen and the Future of Energy', European Liberal Forum, July, https://liberalforum.eu/wp-content/uploads/2021/10/Research-Paper-Clean-Hydrogen-and-the-Future-of-Energy.pdf.
Silvestre, R. (2023). 'Energy Solidarity as Part of a New European Security Structure'. In F. Cappelletti (ed.), *Towards a New European Security Architecture*, pp. 33–41. Brussels: European Liberal Forum.
Tagliapietra, S., & Veugelers, R. (2020). 'A Green Industrial Policy for Europe', Bruegel Blueprint Series, https://www.bruegel.org/sites/default/files/wp_attachments/Bruegel_Blueprint_31_Complete_151220.pdf.
Trichet, J.-C. (2009). 'Speech by Jean-Claude Trichet, President of the ECB at the Ceremony Conferring the Honorary Title of Doctor Honoris Causa at the University of National and World Economy, Bulgaria in Sofia', European Central Bank, 12 June, https://www.ecb.europa.eu/press/key/date/2009/html/sp090612.en.html.

Energy Transition: Challenges and Recommendations for EU Competitiveness

Simona Benedettini

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

This chapter offers an overview of the investment required to achieve the EU 2030 climate and energy targets. Based on an analysis of the financing needs for delivering the decarbonisation of the EU energy sector, it provides an indication of the main challenges to be addressed to meet these. Such challenges include cost increases that make it difficult for clean energy technology manufacturers to operate profitably and a dependence on third countries for raw materials. The chapter also provides recommendations to avoid negative externalities of energy transition policies on EU competitiveness: Member States should simplify procedures for building and operating clean energy sources; develop non-discriminatory and transparent rules for participation in electricity markets; and promote energy sector competition.

ABOUT THE AUTHOR

Simona Benedettini is an energy economist and independent consultant on energy policies and regulation.

INTRODUCTION

The 2021–2022 energy crisis led to a significant revision of the EU's strategy and policies concerning the energy transition. Following the turmoil that energy markets experienced in 2022, the EU's climate and energy targets, set in 2021, have been substantially revised and made more ambitious to accelerate the decarbonisation of the European energy sector and to achieve greater energy independence.

The more ambitious approach to the decarbonisation of the EU energy sector essentially focuses on taking actions in three areas: diversifying natural gas supply sources, increasing efforts to achieve energy efficiency, and promoting greater use of renewable sources in final energy consumption.

Such actions were proposed in May 2022 in the Communication of the European Commission on the REPowerEU Plan (EC, 2022a). The effective implementation of the REPowerEU Plan will require EU Member States to make significant investments within a limited time horizon. According to the Communication, the execution of the REPowerEU Plan will require €300 billion from 2022 to 2030 in addition to the expenditures needed to implement the policy interventions set out in the 'Fit for 55' package. The REPowerEU investments correspond to about 5 per cent of the total 'Fit for 55' investments up to 2030. By the end of 2027, this corresponds to approximately €210 billion in investments.

The Commission estimates that about €620 billion in additional annual investments will be needed to successfully promote the energy transition and that the greatest part of these resources will have to come from private funding. These resources are in addition to those the EU is already set to spend on climate-relevant action for the 2021–2027 period and amount to about €578 billion – at least 30 per cent of its budget (EC, 2023d).

In this context, EU Member States were obliged to update their National Energy and Climate Plans (NECPs) by June 2023 to include the policy interventions they intend to adopt in order to implement the REPowerEU Plan. They were also obliged to update their Recovery and Resilience Plans (RRPs) by September 2023 to include a dedicated chapter with new actions to deliver on the REPowerEU objectives.

However, despite the unprecedented level of investments required to achieve the 2030 decarbonisation goals, the European Commission observes that 'in their draft updated NECPs, most Member States do not present an overview of the expected total investments needed for the 2020–2030 period' and that 'no Member State provides an estimate of the gap between these needs and the available funding sources' (EC, 2022b).

In the light of the picture described above – which seems to suggest that Member States are not devoting sufficient attention to the relevance and implications of the financial effort required to accelerate the EU decarbonisation process – the chapter provides a critical understanding of the following aspects:

- how the investments that EU Member States will make to deliver the REPowerEU Plan will be sourced; and
- all else being equal, what challenges the EU might face in the successful implementation of the REPowerEU plan.

Based on an understanding of the two above-mentioned aspects, and in the light of newly emerging macroeconomic and geopolitical scenarios at the global level, the chapter addresses the following questions:

- What might the implications be of the financial commitment to deliver the energy transition for the competitiveness of the EU?
- What factors might mitigate the adverse effects of the relevant costs of the energy transition on the competitiveness of the EU and transform such costs into growth-enhancing drivers?

The chapter is organised as follows. The second part discusses the aims and content of the REPowerEU Plan to provide an overview of the investments required to deliver the decarbonisation of the energy sector in 2030. The third part analyses the funding sources and financial challenges to be addressed to implement the investments discussed in the second part. The fourth part outlines the additional challenges, beyond the financial ones, faced by the EU in delivering its climate and energy goals. The same section assesses the implications of both financial and non-financial challenges for EU competitiveness. The fifth part provides some recommendations on how to mitigate the impacts of the financing needs of the energy transition on EU competitiveness and turn such investments into growth-enhancing drivers.

THE REPOWEREU PLAN: A NEW APPROACH TO THE ENERGY TRANSITION

The energy crisis of 2021–2022 led the EU to a significant revision of its energy strategy. The revision concerned not only the climate and energy targets at the heart of the EU's energy policies but also the overall meaning of such targets. Prior to the Russian invasion of Ukraine, climate and energy targets were essentially the tool through which the EU would have achieved greater environmental sustainability, better living standards for EU citizens, and more affordable energy prices for EU consumers:

> [The EU Green Deal] resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task. The atmosphere is warming and the climate is changing with each passing year. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are being polluted and destroyed. The European Green Deal is a response to these challenges. (EC, 2019: 2)

Following the energy crisis, climate and energy targets also became the instrument through which to ensure greater EU energy security.

The Communication of the European Commission on the REPowerEU Plan (EC, 2022b) is the cornerstone of such changes in the approach to EU energy policies. Indeed, the Communication, which was adopted in May 2022, has the explicit aim of 'rapidly reducing the EU dependence on Russian fossil fuels by fast forwarding the clean transition'. Since at that time imports from Russia accounted for about 44 per cent, 25 per cent, and 52 per cent for, respectively, natural gas, oil, and hard coal,[1] reducing the EU's dependency on Russian fossil fuels is equivalent to reducing its energy dependency on fossil fuels more generally. The REPowerEU Plan builds on three main areas of investments to achieve greater energy security: energy savings, diversification of natural gas supply, and clean technologies, mainly concerning the use of renewable sources in energy consumption.

TABLE 1: **Main measures and investments of the REPowerEU Plan**

Measure	m^3 bn (in 2030)	Investments (2022–2030, €bn)
Diversification (additional liquefied natural gas (LNG) using existing infrastructure)	50	
Diversification of pipeline imports using existing infrastructure	10	
Delayed phaseout and more operating hours for coal	24	2
Abandoned phaseout of nuclear plants	7	
Fuel switch in the residential and service sectors	9	
EU Save: Demand measures (behaviour)	(10)	
EU Save: Industry curtailment		
New LNG infrastructure and pipeline corridors		10
Additional investments in the power grid and storage		39
Biomass in power generation	1	2
Energy efficiency and heat pumps	37	56
PV and wind	21	86
Sustainable biomethane	17	37
Reduced use in industry	12	41
Renewable hydrogen	27	27
Total	**310**	**300**

In particular, the REPowerEU Plan envisages the interventions as laid out in Table 1.

From a legislative point of view, the REPowerEU Plan builds on the 'Fit for 55' package. The latter translates into policy initiatives to attain the climate goals set by the EU Climate Law for 2030 and 2050,[2] and the actions set out in the EU Green Deal to achieve the EU Climate Law targets. In particular, the EU Climate Law established a binding goal of reaching carbon neutrality by 2050 and reducing greenhouse gas emissions in the EU by at least 55 per cent by 2030 compared with 1990 levels. To this end, the 'Fit for 55' package approved in 2021 adapted existing legislation by introducing a wide range of policy interventions, the most relevant being the adoption of 2030 targets for energy efficiency and consumption from renewable energy sources.

In particular, the 'Fit for 55' package established the revision of the Energy Efficiency Directive (EED) by introducing a binding improvement in energy efficiency (EE) of 9 per cent by 2030, and of the Renewable Energy Directive (RED) by establishing a binding share of renewable sources (RES) on final energy consumption of at least 32 per cent in final energy consumption by 2030.[3]

As shown in Table 1, from 2022 to 2030, the REPowerEU Plan will require additional investments by EU Member States of about €300 billion, or approximately €210 billion by the end of 2027. In combination with the estimated level of investment needed to deliver the policy interventions set out in the 2021 version of the 'Fit for 55' package, such additional investments bring the expenditures of EU Member States to deliver the 2030 decarbonisation goals to about €300 billion. In particular, the incremental investment needs come from the following areas of interventions needed to implement the actions set out in the REPowerEU Plan (see Table 1):

- €113 billion for renewables (€86 billion) and key hydrogen infrastructure (€27 billion) by 2030;
- €29 billion for the power grid by 2030 to enable greater electricity use;
- €10 billion in investments to import sufficient LNG and pipeline gas by 2030;
- €1.5–2 billion for security of the oil supply;
- €41 billion for adapting industry to use less fossil fuel by 2030;
- €56 billion for energy efficiency and heat pumps by 2030; and
- €37 billion to increase biomethane production by 2030.

As is clear from Table 1, the most relevant part of the required investment is for the deployment of renewable energy (28 per cent) and energy efficiency technologies (18 per cent). At the end of 2023 a new version of both the EED and RED entered into force to make EE and RES 2030 targets consistent with the requirements under the REPowerEU Plan. In particular, the 2030 RES target has been increased to 42.5 per cent and the EE target to 11.7 per cent.

FINANCING THE EU ENERGY TRANSITION: MIND THE GAP

According to the EU Commission, the additional €300 billion of investments to deliver the energy transition to 2030 will be financed mainly by the Recovery and Resilience Facility (RRF), which will represent the cornerstone of the grants and loans the EU will mobilise to support EU Member States in financing the REPowerEU Plan. In particular, the Commission plans to mobilise about €72 billion in grants and approximately €225 billion in loans.[4] In addition, other financing sources are available at the EU level to deliver climate and energy targets in 2030: the Connecting Europe Facility, the InvestEU Programme, the Innovation Fund, the Life Programme, and programmes under shared management such as the European Regional Development Fund, including Interreg, the Cohesion Fund, Modernisation Fund, and Just Transition.

To this end, Member States were given the responsibility to add and submit to the European Commission, by September 2023, a REPowerEU chapter to their RRPs to channel investments to REPowerEU priorities and make the necessary reforms. Similarly, they were obliged to update their NECPs by June 2023 to reflect the additional policy interventions needed to deliver the REPowerEU Plan.

Furthermore, given the original investment needs implied by the 'Fit for 55' package, the resources made available at the EU level are not sufficient to deliver the decarbonisation goals of the EU in 2030. The European Commission estimates that higher fuel costs and additional efforts to reduce gas consumption will increase the cost of the energy system by almost 10 per cent, to about €1.9 trillion per year, because of the joint implementation of the 'Fit for 55' and REPowerEU measures. As a share of GDP, this means the system costs will increase from 11.3 per cent of GDP to 13.4 per cent (EC, 2022c). According to the European Commission, the joint implementation of the Fit-for-55 and REPowerEU proposals will generate monetary benefits as well. In particular, it is estimated that the EU can save €80 billion on gas import expenditures, €12 billion on oil import expenditures, and €1.7 billion on coal import expenditures.

All else being equal, the data discussed above suggest the following:

- The years ahead will be characterised by a significant increase in energy costs, mainly due to the expenditure needs triggered by the decarbonisation policies and the need to reduce consumption of fossil fuels.
- The increase in energy costs will not be offset, at least in the medium term, by sufficient monetary benefits in terms of savings led by the reduced dependency of the EU on fossil fuels;
- The resources made available at the EU level are not sufficient to cope with the estimated increase in energy costs, and therefore Member States face the challenge of developing alternative financing sources especially from the private sector (EC, 2023d).
- Member States are struggling to provide information about the gap between the funding needed to deliver the energy transition and available funding sources (EC, 2022a).

Therefore, given the lack of a clear picture about the funding sources needed to cope with the relevant value of resources required by the energy transition and the need to fill the funding gap mostly from private resources, the next two sections of the chapter will address the following questions:

- What are the implications for the EU's competitiveness when Member States primarily use public funding for the energy transition, beyond what EU financing mechanisms offer?
- What are the recommended reforms and regulatory measures to be put in place to encourage private investments and reduce the need to rely on Member States' public funding to deliver the decarbonisation goals?

DECARBONISATION AND COMPETITIVENESS: IMPACTS AND CHALLENGES

The competitiveness of EU industry is both a prerequisite and a consequence of the investment needs to deliver the ambitious EU climate and energy targets. The less competitive the clean energy industry is, for example, the greater the need will be, all else being equal, to support such industry by means of state intervention. In turn, state interventions will put increasing pressure on energy costs – especially if state incentives are financed by means of energy bills – by further reducing the competitiveness of EU industries.

To this end, the 2023 Competitiveness Report (EC, 2023a) highlights that the competitiveness of the EU clean energy industry is decreasing:

> In the global race to net-zero, EU manufacturers are falling behind, and this could undermine [the EU's] economic security. The EU wind energy sector's market share fell from 58% in 2017 to 30% in 2022, in particular due to the rapid growth of wind deployment in China. The EU's trade balance

deficit for individual heat pumps more than doubled between 2021 and 2022. Furthermore, solar PV prices reached a record low in September 2023 due to intense competition and oversupply of components across the whole value chain, making it more difficult for EU manufacturers to produce profitably. While Europe's share in global investment in lithium battery production capacity fell from 41% in 2021 to 2% in 2022, battery factories are being built with increasing speed across Europe and are projected to meet most of EU demand by 2030.

Therefore, in light of the significant investments required to implement both the REPowerEU Plan and the 'Fit for 55' package, and of the EU's ambition to become the global leader in the green transition,[5] Member States are likely to continue providing subsidies to support the market penetration of clean energy technologies. Despite energy prices remaining high and above the pre-crisis level, the increasing production costs make it difficult for EU clean energy technology manufacturers to operate in a profitable manner and for operators to make a profit on energy markets. Firstly, higher inflation and interest rates make it difficult to access material inputs and credit resources. Secondly, the recent turmoil in the Middle East region has generated discontinuities in the supply chain, further increasing production costs.

The EU's dependence on third countries for raw materials is a further source of pressure on the competitiveness of the EU's clean energy industry. For example, the EU imports 98 per cent of its rare-earth supply and 97 per cent of its magnesium from China, about 80 per cent of its lithium from Chile, and more than 60 per cent of its cobalt from the Democratic Republic of the Congo. In addition, the EU is significantly dependent on the United States for general design tools and on Asia for advanced chip fabrication. China is also the main manufacturer at the global level of key segments of batteries and solar PV (over 60 per cent of global manufacturing capacity) and wind turbines (50 per cent of global production in 2022).

The data on the competitiveness of the EU clean energy industry and the increasing role of the United States, China, and other Asian countries on the global market for clean energy technologies further suggest that Member States would need to find additional resources besides those made available at the EU level to effectively deliver the decarbonisation goals.

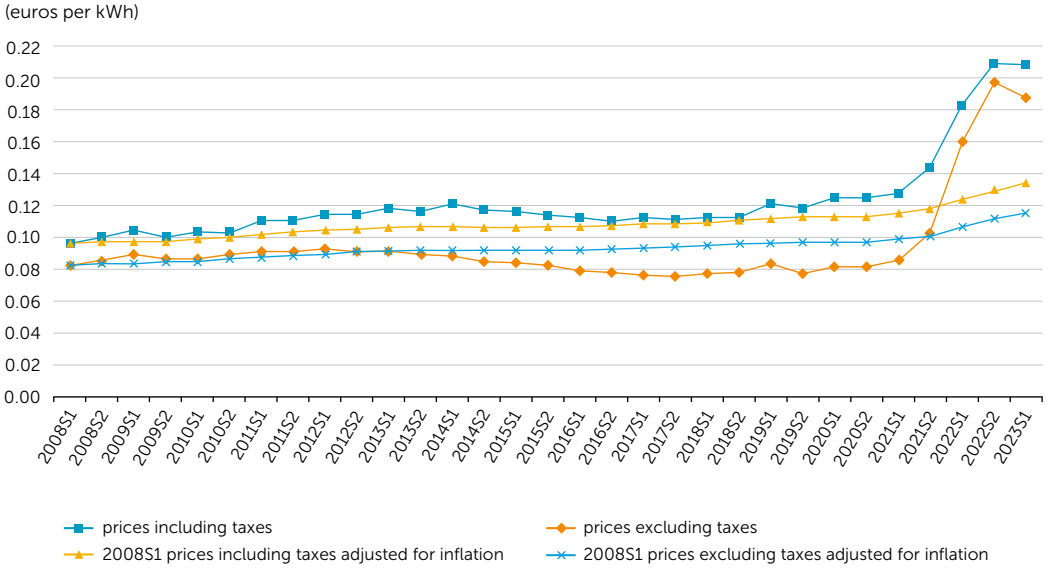
To this end, the Temporary Crisis and Transition Framework (TCTF) (EC, 2023c) adopted in March 2023 cannot be considered an effective measure. Among other measures, the TCTF permits aid to all renewable technologies and to renewable hydrogen and biofuel storage and eliminates the need for open tendering procedures for less mature technologies. In reality, given the different levels of indebtedness of EU governments, the TCTF will be exploited mainly by those Member States that have sufficient resources to finance subsidies. The result will be that different Member States will end up providing varying levels of support to the clean energy technology industry, thus weakening the competitiveness and strength of the EU as a whole on the global market. The same result has been observed with respect to the policies implemented during the energy crisis to mitigate energy prices and invest in alternative gas supply sources. Member States with 'healthy' balance sheets have been able to invest sooner and better in alternative supply sources as well as to provide greater support to industrial and domestic customers to deal with high energy prices. Therefore, a common and homogeneous response at the EU level has failed to materialise.

In addition, in the context of increasing electricity prices for industrial customers and small and medium-sized companies (see Figure 1), a greater increase in energy costs driven by energy subsidies might further weaken the competitiveness of the EU industry.

Member States are likely to continue providing subsidies to support the market penetration of clean energy technologies

In addition, as shown in Figure 1, the increase in electricity prices has been driven mainly by additional components such as taxes and levies, which on average account for between 20 and 40 per cent of energy bills. According to the EU, the total amount of energy subsidies in the EU-27 increased from €177 billion in 2015 to €216 billion by 2021. As a direct consequence of the energy crisis, this amount was expected to reach nearly €390 billion at the end of 2022. Therefore, a further increase in subsidies might put at greater risk the competitiveness of the EU industry, which is already suffering from high energy prices, high interest and inflation rates, and difficult access to input raw materials.

FIGURE 1: **Electricity prices for non-household customers, 2008–2023**



Source: Eurostat.

HOW TO SUPPORT EU COMPETITIVENESS TO DELIVER A VALUABLE ENERGY TRANSITION

Given the picture described in the previous sections, it is clear that delivery of the EU's ambitious climate and energy targets will cause an unprecedented increase in energy system costs which cannot be funded by public sources alone but will need to be supported mostly by private investments.

It is therefore important that Member States pursue all necessary measures to promote an adequate level of competition for and in energy markets to allow the overall reduction of costs for the production and operation of such technologies and to identify those technologies which can best support the achievement of the decarbonisation goals at lower cost.

Firstly, it is strongly recommended that Member States facilitate and further simplify the permitting procedures to build and operate clean renewable energy technologies. Despite the EU having set binding principles in its recommendations and guidance to speed up permitting procedures,[6] Member States seem to struggle in implementing consistent reform. As observed by the EC in its assessment of the NECPs, the picture is heterogeneous across Member States (EC, 2022a).

Secondly, the development of non-discriminatory and transparent requirements and rules to participate in electricity markets is essential to allow different technologies to contribute to delivering the EU's ambitious energy goals. The realisation of a level playing field is essential to reduce the costs of participation in electricity markets and therefore to exploit all the available technologies at the lowest possible cost. The REPowerEU Plan does not seem to consider exhaustively the contribution that demand resources might make to the decarbonisation of the energy sector. The energy crisis demonstrated that demand response can play a relevant role in supporting energy security and sustainability. The report of the European Commission on implementation of the emergency measures introduced with EU Regulation 2023/1854 to address high energy prices highlights that, on average, EU countries reached a reduction of energy consumption of around 7 per cent, with some countries reaching a level of 10 per cent or more (EC, 2023e). The demonstrated contribution of demand resources to the flexibility and adequacy of the electricity system has been well addressed in the revision of EU Directive 2019/944 (EC, 2023b), approved by the European Council and the Parliament at the end of 2023. The reform of the EU electricity market design establishes that Member States shall address their own flexibility needs from non-fossil technologies and, to this end, remove barriers to the participation of such technologies in electricity markets. In addition, if the conditions set in the EU legislative framework are met, Member States may consider the introduction of support schemes to promote the participation of demand resources in flexibility markets and capacity mechanisms. Therefore, it is imperative that Member States act to remove the technical, economic, and

regulatory barriers to the participation of demand response to electricity markets. Such participation will also lower the pressure of the dependency on raw materials. At the same time, demand response can be a key driver to increase the competitiveness of the EU industry by reducing energy bills.

Thirdly, promoting more competition in general in the energy sector by ensuring an appropriate implementation of unbundling regimes and removing unjustified forms of wholesale and retail price regulation in electricity and gas markets will allow for the development of an appropriate space for new and innovative technologies and the formation of efficient price signals necessary to guide investment decisions.

NOTES

1. EU Energy in Figures, https://op.europa.eu/en/publication-detail/-/publication/bb9f16ee-642f-11ee-9220-01aa75ed71a1/.
2. 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, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119.
3. 'Fit for 55' package, https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/.
4. How REPowerEU is funded, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en#how-repowereu-is-funded
5. The EU as a global leader. Section 3 (EC, 2019).
6. European Commission, Enabling framework for renewables, https://energy.ec.europa.eu/topics/renewable-energy/enabling-framework-renewables_en.

REFERENCES

EC (European Commission). (2019). 'The European Green Deal'. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF.

EC (European Commission). (2022a). 'Communication: EU Wide Assessment of NECPs'. https://eur-lex.europa.eu/resource.html?uri=cellar:bb8fb395-9d9c-11ee-b164-01aa75ed71a1.0001.02/DOC_1&format=PDF.

EC (European Commission) (2022b). 'Communication: REPowerEU Plan'. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN.

EC (European Commission). (2022c). 'Implementing REPowerEU Plan SWD'. https://commission.europa.eu/document/download/b6f48e42-a105-4fc3-8e27-fa078e4337ae_en.

EC (European Commission). (2023a). '2023 Progress Report on the Competitiveness of Clean Energy Technologies'. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0652.

EC (European Commission). (2023b). 'Commission Welcomes Deal on Electricity Market Reform'. Press release, 14 December. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6602.

EC (European Commission). (2023c). 'Communication from the Commission – Amendment to the Temporary Crisis and Transition Framework for State Aid Measures to Support the Economy Following the Aggression against Ukraine by Russia'. https://competition-policy.ec.europa.eu/state-aid/temporary-crisis-and-transition-framework_en.

EC (European Commission). (2023d). 'Strategic Foresight Report'. https://commission.europa.eu/system/files/2023-07/SFR-23-beautified-version_en_0.pdf.

EC (European Commission). (2023e). 'Report from the Commission to the European Parliament and the Council on the Review of Emergency Interventions to Address High Energy Prices in Accordance with Council Regulation (EU) 2022/1854'. https://op.europa.eu/en/publication-detail/-/publication/4eefee04-0383-11ee-87ec-01aa75ed71a1.

Sustainable Development and EU Industrial Sovereignty: The Role of Connectivity and Technology

Heather Johnson and Gabriel Solomon[1]

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

The chapter examines how transformational mobile connectivity can enable lower carbon operations across the economy in general. It argues that the effectiveness of the parallel policy paths for the twin transitions could be amplified if they were joined at the hip. It cites recent evidence confirming interdependencies between connectivity solutions and carbon abatement and suggests that transformational connectivity should be included in the EU's taxonomy.

ABOUT THE AUTHORS

Heather Johnson is Vice President for Sustainability and Corporate Responsibility for Ericsson worldwide. Since 2007 she has pioneered programmes, practices, and targets embedded across the company including net-zero commitment across the value chain by 2040, human rights due diligence, health, safety and well-being programmes, and robust ESG reporting to transparently communicate Ericsson's progress in these areas. She manages relationships with the UN and other international organisations. Ms Johnson holds an MBA from Santa Clara University.

Gabriel Solomon is Head of Global Advocacy at Ericsson. He collaborates across governments, regulators, businesses, and associations to facilitate positive conditions to achieve pervasive transformational connectivity. He holds an MBA from INSEAD and is Chairman of the UK Telecommunications Academy, a charity providing accredited master's degrees to thousands of students in emerging markets.

INTRODUCTION

Europe's ambitious Green Deal establishes policies that are expected to reduce net greenhouse gas (GHG) emissions by at least 55 per cent by 2030 compared with 1990 levels.[2] The EU's industrial strategy goes further, aiming to use low-emission technologies and sustainable products and services to achieve climate neutrality by 2050.[3] To this end, a taxonomy for sustainable activities has been established,[4] and more recently the EU has revised its energy efficiency directive.[5]

In her 2023 State of the Union Address, European Commission President Ursula Von der Leyen stated that 'we now have a European Green Deal as the centrepiece of our economy and unmatched in ambition [and] have set the path for the digital transition and become global pioneers in online rights'. The objectives of the twin transitions are highly commendable and interdependent, but they follow parallel policy-making paths. Interconnecting them could lead to a more effective approach and a more efficient outcome.

INTERDEPENDENT TRANSITIONS

The deployment and use of transformational connectivity,[6] information and communications technologies (ICT), and other digital technologies can drive more efficient use of energy by reducing the amount of energy needed to deliver a product or service, eliminating wasteful energy consumption, or changing behaviours that affect consumption (World Energy Council, 2018). Indeed, ICT solutions have the potential to directly reduce global GHG emissions by up to 15 per cent by 2030 compared with a 2015 baseline (Malmodin & Bergmark, 2015).

While noting the 'rebound effect',[7] where reducing the marginal cost of energy enabled by digital solutions can lead to increased energy consumption as exponential end points are connected and

used, empirical evidence suggests that while the number of subscriptions to both fixed and mobile broadband services has increased, country-level emissions have decreased. An analysis between 2002 and 2020 of 181 countries found that an initial increase in CO_2 emissions for a country at an average emissions level once mobile broadband is introduced was greatly offset by the positive externalities of connecting to and using the network: on average, a 10 percentage point increase in mobile broadband penetration causes a 7 per cent reduction in CO_2 emissions per capita (Edquist & Bergmark, 2022).

It does not take a great leap of faith to intuit how the positive externalities of transformational connectivity not only offset the sectors' own emissions but also are a direct facilitator of new operational modes for public services, industries, small and medium-sized enterprises, households, and individuals that are required to deliver the Green Deal. Increasingly new and consistent data are available that suggest strong causality.

The International Telecommunication Union (ITU) recently agreed on a standard to assess how the use of ICT solutions impacts GHG emissions in other sectors.[8] The new recommendation introduces a methodology for assessing the full emissions impact of ICT solutions, including:

- first-order effects relating to the environmental impacts caused at each stage of their life cycles;
- positive second-order effects enabled through vast efficiency gains in all sectors of the economy;
- negative second-order effects caused by ICT solutions serving to maintain or even increase the fossil-based economy; and
- higher-order effects (may be positive or negative) caused by the structural impact on a societal level in reshaping lifestyles.

The ITU standard was applied to an innovative solution in one of the highest-emitting sectors, building energy and heating. The life cycle of buildings accounts for 36 per cent of total GHG emissions in the EU alone.[9] The Carbon Trust developed a case study of a solution provided by Ericsson and Kiona, a building management solution provider:

- Using the ITU standard, the study delivered a comprehensive assessment of the total first-, second-, and higher-order effects of the total energy optimisation solution across 365 residential buildings in Finland and Sweden over the course of 12 months.
- This comprised primary data from Kiona's cloud-based Edge platform, the radio network, Internet of Things (IoT) accelerator platform, a number of temperature and humidity sensors, and gateways that transmit the data to the cloud platform.
- It also comprised secondary data from other reliable sources to fill data gaps, including contextual issues such as cost factors, macroeconomic factors, and environmental regulations. Higher-order effects were also assessed and comprised factors such as economic efficiency and the potential for an increase in carbon-emitting activities, for example.
- Net second-order effects were presented as the average annual change in GHG emissions per square metre of each building. To calculate this, the aggregated first-order effects were subtracted from GHG emission changes for each building. Furthermore, buildings were categorised based on characteristics such as building year, ventilation type, and exhaust type to provide a wider data set for evaluation.

The solution resulted in a positive net second-order effect, reducing GHG emissions. In 2022, the total net avoided emissions for the data set were found to be 1,111 tonnes of CO_2 equivalent (tCO2e) for the location-based method and the total net avoided energy consumption was 17,325 megawatt hours (MWh), which is 7 per cent of the total (Ericsson & Kiona, 2023).

The sample data set comprises buildings that exclusively use district heating (with relatively low emissions). This would indicate the potential for even greater savings in locations with less favourable conditions. Compared with other time-consuming and costly energy-saving methods such as glazing, it only takes a couple of hours to implement the digital solution.

The example above gives weight to previous claims that by 2030, connectivity could help reduce EU emissions by approximately 550 metric tons of CO2e (MtCO2e), the equivalent to 15 per cent of the EU's total emissions in 2017 (McKinsey Sustainability, 2020). Additional modelling suggests that by 2030 a further 55–170 MtCO2e of emissions savings per annum would be possible, but only through the deployment and use of transformational 5G technology and solutions across four high-polluting sectors: power, transport, industry, and buildings (Ericsson, 2021).

Perhaps the most radical and sustained change in behaviour enabled by connectivity is the working from home (WFH) phenomenon. According to economist and WFH expert Nick Bloom,[10] before the COVID-19 pandemic about 5 per cent of full paid days were worked from home across Europe and America. Now about 25 per cent of the workforce is on a hybrid

schedule, working from home typically one or two days a week. Another 8 per cent are working a fully remote schedule. Overall, about 20 per cent of all days are now worked from home (*The Economist*, 2023).

Two powerful economic forces will drive WFH up, perhaps to 30 per cent of days worked a decade from now. The first and most powerful of these is improving technology. In 1965, just 0.4 per cent of days were worked from home in America. The share then doubled roughly every 15 years up to 2019, driven by technological advances. These included the personal computer in the 1980s, the spread of laptops in the 1990s, the explosion of the Internet in the 2000s, and most recently cloud file-sharing and video calls (*The Economist*, 2023).

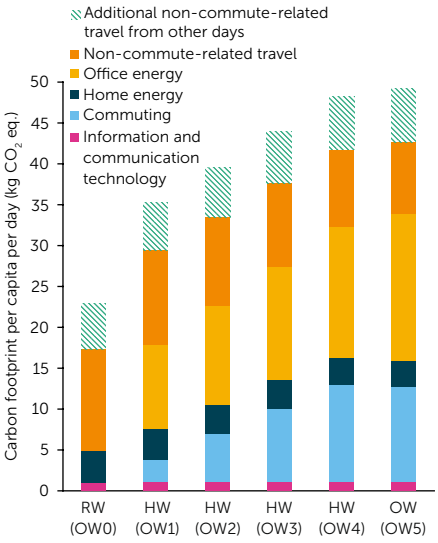
The second force supporting remote working is business 'cohort effects'. Data show that younger start-ups tend to be more remote-focused. These firms have been born in an era when having an office is optional and meeting customers and business partners online is standard. Many see forgoing offices and using more remote workers as a key cost-saving strategy. As a result, employees at today's new firms work almost twice as many days from home as those at firms founded 30 years ago (*The Economist*, 2023).

With less travelling to work, the environment benefits. WFH has reduced global commuting by 80 billion kilometres a year from the pre-pandemic level. A new paper in the *Proceedings of the National Academy of Sciences of the USA* calculates the impact of WFH frequency from zero to five days a week on carbon emissions. It combines commuting, non-commuting travel (e.g. driving to buy lunch if you WFH), office energy, home energy, and ICT energy. It finds moving to two days a week reduces carbon use by 11 per cent, four days by 29 per cent, and five days a week by a substantial 58 per cent (Tao et al., 2023). The main saving drivers are less commuting and office closures.

For firms, this highlights how a supportive WFH policy can deliver progress on climate objectives. Indeed, these effects are so large that WFH policies are likely to be one of the most powerful tools for companies trying to reduce their carbon footprint (see Figure 1).

A recent connectivity-driven, artificial intelligence (AI)-optimised traffic signal timing solution demonstrates the potential to reduce stop/starts by 30 per cent and intersection emissions by 10 per cent (Matias, 2023).

FIGURE 1: **Fully remote work can reduce employees' carbon footprint by 58 per cent vs fully in office**



DIGITAL DECADE DILEMMAS

Understanding that connectivity is a critical enabler for future growth, competitiveness, resilience, and industrial sovereignty and a necessary input to achieve the Green Deal, the EU has set out bold objectives for gigabit connectivity (fibre and transformational 5G) by 2030. However, according to publicly available data, the EU is lagging behind other regions of the world,[11] not least in the availability of transformational 5G,[12] where Europe only has 25 per cent population coverage, far behind North America at 85 per cent and China at 95 per cent,[13] while India has undergone the fastest 5G roll-out ever, commissioning 400,000 5G sites in just 15 months.[14]

The EU is rightly concerned that the market is not on track to deliver its digital decade targets due to the financial health of the industry, which has insufficient margins to make the required investments. As a result, WIK-Consult were commissioned to estimate the investment gap. By using WIK-Consult's cost and viability model, we seek to provide an estimate of the costs of achieving the recently adopted Digital Decade goals, taking into account the progress that has been made thus far in deploying high-speed fixed and mobile networks.

- Around €114 billion in investment will be required to achieve the fixed gigabit coverage goal using fibre-to-the-premises (FTTP). €33.5 billion is estimated to be needed for the provision of 'full 5G service' (with additional base stations and small cells, mostly for the mid- or high-5G bands).

- This makes the overall investment gap reach at least €174 billion, including the public funds that may be required, but more likely beyond €200 billion depending on the options considered. It is important to note that, as 2030 approaches, more intense, industrial use of connectivity for Internet 4.0 scenarios, and increasing security requirements, are likely to push investment needs much higher. (European Commission, 2023c)

While the EU is considering new policy interventions to facilitate the emergence of pan-European operators with sufficient scale by addressing the sector's fragmentation and national hegemony (Breton, 2023), there are some pivots to the existing policy toolbox available at both the Member State and EU level that could be brought to bear in a much shorter time frame.

SUSTAINABLE MARKET STRUCTURES

While the EU aims to facilitate pan-European operators, there is no existing regulatory impediment to prevent cross-border mergers and acquisitions. The problem has been that these cross-border deals have, in the main, destroyed value as national markets have remained largely sub-scale and unsustainable. Per capita telecom investment in Europe is 15 per cent lower than in South Korea and more than half that in Japan and the United States. Over the last 15 years, average telecoms spend per capita has fallen by 16 per cent in Europe, while in Korea and the United States it has increased by 19 per cent and 24 per cent respectively (ETNO, 2020).

Mobile markets are characterised by dynamism and subject to rapid and constant innovation, which can exponentially increase quality, lower unit costs, and boost consumer surplus. EU competition policy should consider the effect of incentives for ongoing innovation and investment. This is recognised in other locations such as Australia, India, and the United States, where the consolidation of mobile operators was allowed as firms sought scale to improve their balance sheets and fund 5G network investments. In Europe, when mergers were approved, the remedies imposed often dampened the expected efficiencies gains.

In Australia, a four-to-three consolidation was approved, where the merged firm's 'ability to invest additional capex in its network will enable it to offer high-quality 5G services to customers far sooner' was cited as justification for the decision.[15] In the US four-to-three mobile merger ruling, one firm was 'caught in a vicious cycle caused by its inability to finance meaningful network investment, which perpetuates a low-quality network that drives away customers'. The merged firm's combined spectrum assets (mid-band and low frequency) was seen not only to incentivise greater investment but also to amplify its effect by multiplying the 'network's capacity because a technological innovation referred to as *carrier aggregation*' could be used.[16] As part of the approval process, the merged party committed within three years to deploy 5G service to cover 97 per cent of the American people, and within six years to reach 99 per cent of all Americans. This commitment includes deploying 5G service to cover 85 per cent of rural Americans within three years and 90 per cent of rural Americans within six years.

> Merger control in other regions has been used strategically. Rather than imposing strict structural remedies, authorities in Australia, India, and the United States allowed in-market consolidation on the condition that the merged firm committed to building out 5G infrastructure quickly and expansively. Europe should follow this example. (FCC, 2019)

Removing deployment barriers

The EU has taken positive steps to remove deployment barriers that are artificial hurdles, delaying and adding cost to infrastructure deployment. The Connectivity Toolbox sets out a compilation of best practice and asks Member States to report back on progress on working towards them.[17]

> The EU has now doubled down with its proposed Gigabit Infrastructure Act that, when passed and transposed, would require Member States to act. (EC, 2023a)

Trading off fees for deployment commitments

Member States also have meaningful tools to incentivise infrastructure buildout. There is a growing recognition among policy-makers that spectrum fees are not just a sunk cost but also have a direct impact on the industry's financial health. More than €25 billion was earned by Member States through the latest round of spectrum auctions, taking the total to around €200 billion over the last 20 years, the equivalent of well over ten years of annual mobile capital expenditure.

The major spectrum costs of the coming years will likely be renewals of existing licences. In Europe, annualised spectrum fees equal around 30 per cent of total mobile capital expenditure and drag down capital returns by around 20 per cent, a main driver of the industry's poor financial health.

Some governments have already used spectrum licensing strategically by trading off fees for binding deployment commitments. Encouragingly, more are considering doing so. Extending communications services provider spectrum licences by trading off fees for deployment commitments is an opportunity to get the European network platform built quickly; there are precedents for doing so that can be replicated.[18]

Tax incentives

National governments can also consider horizontal funding schemes such as tax rebates. The 'super deduction' scheme that the United Kingdom implemented, which allowed companies to reduce their tax bill by 25 per cent per unit of investment on productivity-enhancing capital investments for a period of two years, was used by telecom operators and others (Reuters, 2021).[19] The IMF advice to European governments is that they should give infrastructure investment an adrenaline shot 'by temporary investment tax credits to bring forward investment', for example, for 'digital and green tech' (IMF, 2021).

Horizontal tax incentives can pull forward investment decisions and, in the case of telecoms networks, accelerate the pace of deployment.

The EU has taken positive steps to remove deployment barriers

State aid

The revised state aid rules for broadband networks provides Member States with substantial flexibility to remedy connectivity market failures in a timely and robust manner (EC, 2022b). There is an unprecedented amount of public funding available through mechanisms such as Next Generation EU.[20] Member States should be encouraged to identify where targeted funding can amplify and not crowd out private sector investment. Successful examples include the €2 billion scheme approved for Italy and the €680 million scheme for Spain (EC, 2022a, 2023b).

Of the Recovery and Resilience Facility's digital portion, some €23 billion (12 per cent of the total) has been earmarked for connectivity and the vast majority of funds have yet to be disbursed (95 per cent remained untapped as of Q2 2023).[21] Member States should consider fast-tracking their approach to quickly expand coverage and increase the use of transformational connectivity and digital solutions.

Demand-side aggregation

Another avenue for both the EU and Member States to consider is incentivising greater demand-side aggregation to pull through connectivity investments. Not only would this stimulate an advance of secure and sustainable digital infrastructure, but it would also boost digital skills, incentivise a swift digital transformation of businesses and public services, and above all set the foundation for a sturdier path to the digital decade.

Public procurement accounts for 14 per cent of Europe's GDP.[22] If the scale of this spending and procurement power included a filter to ensure it tangibly contributed to the twin transitions, it would send a strong market signal to the supply side to meet that demand.

Tethering the policy paths

Given the causal relationship between connectivity infrastructure, digital transformation, and achieving net zero, policy-making should be joined up. The EU's taxonomy regulation is designed to support the transformation of the EU economy to meet its Green Deal objectives, including the 2050 climate-neutrality target. As a classification tool, it seeks to provide clarity for companies, capital markets, and policy-makers on which economic activities are sustainable. As a screening tool, it seeks to support investment flows into those activities.[23]

The EU's taxonomy definitions and rules determine which economic activities are environmentally sustainable and are based on two criteria:

- an activity must contribute to at least one of the six environmental objectives lists; and
- it must do no significant harm to any of the other objectives while respecting basic human rights and labour standards.

The six environmental objectives of the taxonomy are:

- climate change mitigation,
- climate change adaptation,
- sustainable use and protection of water and marine resources,
- transition to a circular economy,
- pollution prevention and control, and
- protection and restoration of biodiversity and ecosystems.

The fact that the taxonomy does not yet clearly incorporate transformational connectivity solutions seems to miss an open goal. For example, while

there is some discussion on 5G, AI, and IoT in terms of transmission rates and analytic capabilities,[24] it is unclear whether the deployment of transformational connectivity solutions is recognised as an eligible activity under the regulation.

From a life cycle assessment perspective, transformational connectivity solutions can have more than seven times lower environmental impacts compared with legacy wireless technologies.[25] And then there is the critical enabling role transformational connectivity affords other sectors. Explicitly including the deployment and use of transformational connectivity in the taxonomy would also align with the EU's energy efficiency directive that binds Member States to collectively ensure an additional 11.7 per cent reduction in energy consumption by 2030 compared with 2020 and help achieve the 'Fit for 55' pledge,[26] cutting EU emissions by 2030 by at least 55 per cent compared with 1990 levels (Council of the European Union, 2023).

While the renewable energy share of the EU's energy consumption has increased by 50 per cent over the last decade, in 2022 renewables still only represented 15 per cent of the total.[27] Little wonder then that since the beginning of the decade, the twin transitions have been central pillars for the EU's sustainable growth strategy (EC, 2020). From a policy perspective, it is high time they became joined at the hip.

NOTES

1. The opinions of the authors do not reflect those of Ericsson.
2. https://climate.ec.europa.eu/eu-action_en.
3. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/industry-and-green-deal_en#actions.
4. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en#eu-taxonomy-navigator.
5. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en.
6. Transformational connectivity refers to step-change technologies such as fibre and gigabit capable 5G, anchored in mMIMO on TDD mid-band with gigabit capable backhaul (fibre/microwave), which delivers a step change in capacity and throughput, further enhanced by carrier aggregation, and when stand-alone core is deployed, a step change in network functionality is enabled.
7. In this context the 'rebound effect' is associated with the observation that efficiency gains tend to be counteracted by increased consumption. The effect could either be direct (the consumption of the ICT solution itself increases due to its accessibility), or indirect (the efficiency gains in terms of money or time are spent on other activities whose impacts partly or fully offset the efficiency gain). There is also a negative rebound effect (which is in fact a positive): if the solution is efficient and expensive it may lead to less consumption of more resource intensive goods or services.
8. https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=15030.
9. Including construction, usage, renovation and demolition.
10. Nicholas Bloom is the William D. Eberle Professor of Economics at Stanford University.
11. See, for example, https://5gobservatory.eu/ and https://www.ftthcouncil.eu/knowledge-centre/all-publications-and-assets/1707/european-ftth-b-market-panorama-2023.
12. 5G on mid band spectrum delivers a step change in capacity and throughput. 5G standalone delivers a step change in functionality.
13. Ericsson Mobility Report, November 2023, p. 22.
14. *The Economic Times*, 11 December 2023.
15. *Vodafone Hutchinson Australia Pty Ltd v Australian Competition and Consumer Commission*, 2020. https://www.australiancompetitionlaw.info/cases/vodafone-v-accc.
16. *State of New York et al v. Deutsche Telekom AG et al*, 2020. https://law.justia.com/cases/federal/district-courts/new-york/nysdce/1:2019cv05434/517350/409/.
17. https://ec.europa.eu/digital-single-market/en/news/eu-member-states-present-report-best-practices-fast-network-rollout-first-step-towards.
18. France, for example, set a precedent in its 2018 New Deal Mobile: https://en.arcep.fr/news/press-releases/view/n/new-deal-mobile-6.html.
19. https://www.gov.uk/guidance/super-deduction.
20. https://next-generation-eu.europa.eu/index_en.
21. https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html.
22. https://single-market-scoreboard.ec.europa.eu/business-framework-conditions/public-procurement_en.
23. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en#faqs.
24. See paragraph 8.2, https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf.
25. https://www.telefonica.com/en/wp-content/uploads/sites/5/2022/03/connectivity-solutions-life-cycle-assessment.pdf.
26. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en.
27. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

REFERENCES

Breton, T. (2023). 'A "Digital Networks Act" to Redefine the DNA of Our Telecoms Regulation'. LinkedIn, 10 October. https://www.linkedin.com/pulse/digital-networks-act-redefine-dna-our-telecoms-thierry-breton/.

Council of the European Union. (2023). 'Fit for 55: How the EU Will Become More Energy-Efficient'. Infographic. https://www.consilium.europa.eu/en/infographics/fit-for-55-how-the-eu-will-become-more-energy-efficient/.

EC (European Commission). (2020). 'Annual Sustainable Growth Strategy 2021', 17 September. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0575&from=EN.

EC (European Commission). (2022a). 'State Aid: Commission Approves €2 Billion Italian Scheme under Recovery and Resilience Facility to Support Roll Out of 56 Mobile Networks'. Press release, 25 April. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2644.

EC (European Commission). (2022b). 'State Aid: Commission Adopts Revised State Aid Rules for Broadband Networks'. Press release, 12 December. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7595.

EC (European Commission). (2023a). 'Gigabit Infrastructure Act Proposal and Impact Assessment', 23 February. https://digital-strategy.ec.europa.eu/en/library/gigabit-infrastructure-act-proposal-and-impact-assessment.

EC (European Commission). (2023b). 'State Aid: Commission Approves €680 Million Spanish Scheme under the Recovery and Resilience Facility to Support Roll Out of 5G Mobile Networks in Rural Areas'. Press release, 15 June.

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3044.
EC (European Commission). (2023c). 'Shaping Europe's Digital Future', 12 July. https://digital-strategy.ec.europa.eu/en/library/investment-and-funding-needs-digital-decade-connectivity-targets#:~:text=This%20makes%20the%20overall%20investment,depending%20on%20the%20options%20considered.
The Economist. (2023). 'Nicholas Bloom Predicts a Working-from-Home Nike Swoosh', 29 August. https://www.economist.com/by-invitation/2023/08/29/nicholas-bloom-predicts-a-working-from-home-nike-swoosh.
Edquist, H., & Bergmark, P. (2022). 'How Is Mobile Broadband Intensity Affecting CO2 Emissions? A Macro Analysis'. 31st European Conference of the International Telecommunications Society (ITS): 'Reining in Digital Platforms? Challenging monopolies, promoting competition and developing regulatory regimes', Gothenburg, Sweden, 20–21 June, International Telecommunications Society, Calgary. https://www.econstor.eu/bitstream/10419/265622/1/Edquist-and-Bergmark.pdf.
Ericsson. (2021). 'Connectivity and Climate Change: Examining the Role of Digital Communications in Combating Climate Change'. https://www.ericsson.com/en/about-us/sustainability-and-corporate-responsibility/environment/connectivity-and-climate-change.
Ericsson & Kiona. (2023). 'Case Study on the Avoided Emissions from a Building Heating Management System Using an AI Steering Function', 15 September. https://www.ericsson.com/4a6bde/assets/local/internet-of-things/reports/research-report-for-the-industrial-decarbonization-challenge.pdf.
ETNO (European Telecommunications Network Operators' Association). (2020). 'The State of Digital Communications 2020'. https://etno.eu/downloads/reports/etno%20state%20of%20digital%20communications%20report%202020.pdf.
FCC (Federal Communications Commission). (2019). 'FCC Approves Merger of T-Mobile and Sprint'. Press release, 5 November. https://docs.fcc.gov/public/attachments/DOC-360637A1.pdf.
IMF. (2021). 'Regional Economic Outlook for Europe', April. https://www.imf.org/en/Publications/REO/EU/Issues/2021/04/12/regional-economic-outlook-for-europe.
Malmodin, J., & Bergmark, P. (2015). 'Exploring the Effect of ICT Solutions on GHG Emissions in 2030'. https://www.ericsson.com/en/reports-and-papers/research-papers/exploring-the-effects-of-ict-solutions-on-ghg-emissions-in-2030.
Matias, Y. (2023). 'Project Green Light's Work to Reduce Urban Emissions Using AI'. *The Keyword*, 10 October. https://blog.google/outreach-initiatives/sustainability/google-ai-reduce-greenhouse-emissions-project-greenlight/.
McKinsey Sustainability. (2020). 'How the European Union Could Achieve Net-Zero Emissions at Net-Zero Cost', 3 December. https://www.mckinsey.com/capabilities/sustainability/our-insights/how-the-european-union-could-achieve-net-zero-emissions-at-net-zero-cost.
Reuters. (2021). 'BT Says "Super Deduction" Will Significantly Cut Tax Bill', 4 March. https://www.reuters.com/article/uk-bt-tax-idUSKCN2AV2TU.
Tao., Y., Yang, L., Jaffe, S., Amini, F., Bergen, P. Hecht, B., & You, F. (2023). 'Climate Mitigation Potentials of Teleworking Are Sensitive to Changes in Lifestyle and Workplace Rather than ICT Usage'. *PNAS*, 120(39), e2304099120. https://www.pnas.org/doi/full/10.1073/pnas.2304099120.
World Energy Council. (2018). 'The Role of ICT in Energy Efficiency Management: Household Sector'. https://www.worldenergy.org/assets/downloads/20180420_TF_paper_final.pdf.

EU Chemicals and the Challenge of EU Industrial Autonomy

Emma Argutyan

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

The chapter explores the imminent transformation of the chemical industry, examining the industry's current undertakings and potential hurdles, particularly after the endorsement of the European Green Deal in 2020. It identifies the key stakeholders responsible for steering this transformation, emphasising the collaborative initiatives of European institutions. It delves into critical issues, including the industry's public perception, the scarcity of a skilled workforce, and the intricacies of workforce transition. It further scrutinises existing EU initiatives designed to facilitate the industry's transition and offers policy recommendations. Finally, it advocates for the establishment of a robust policy evaluation mechanism with periodic impact assessments to ensure the adaptability and continuous improvement of the chemical sector.

ABOUT THE AUTHOR

Emma Argutyan is the Director General of the European Chemical Employers Group (ECEG). Her responsibilities include, amongst others, representing the employers' interests (in the fields of social and industrial policies, skills & competences, H&S, etc.) vis-à-vis the European institutions and its social partner, industriAll European Trade Union. Prior to her current position, Emma worked at the German Business Representation's Brussels office and at the European Parliament. Emma holds an MA in European Studies from the University of Maastricht.

INTRODUCTION

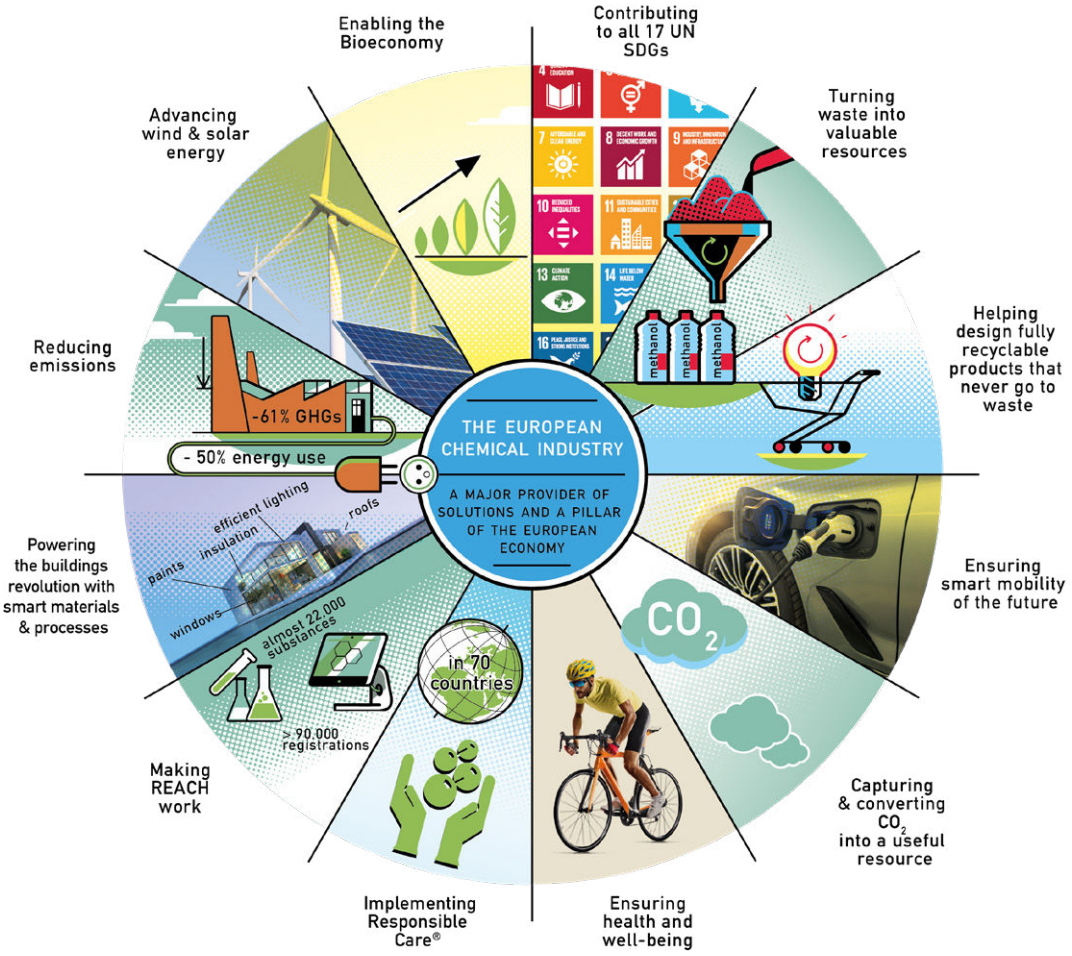
The European chemical industry, which is Europe's fourth largest manufacturing sector and is noted for its energy-intensive nature within the EU, faces a pivotal moment. In line with the broader transformation taking place across the entire European continent, the industry must undergo significant changes. These include meeting imperative targets, such as reducing greenhouse gas (GHG) emissions by 55 per cent by 2030 compared with 1990 and achieving net-zero emissions by 2050.

These targets are part of the European Green Deal, a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy by cutting pollution and to mitigate climate change (EC, 2019a, 2019b). Meeting the objectives of the European Green Deal will require significant investments. Achieving the current 2030 climate and energy targets is estimated to require €260 billion in additional annual investment across the EU, representing about 1.5 per cent of 2018 GDP (EC, 2019b).

The chemical sector plays a pivotal role in various industries (see Figure 1). In the energy sector, it is both a major consumer of and contributor to energy production through materials used in batteries and renewable energy technologies. In manufacturing, it provides essential raw materials, whereas in healthcare, it is crucial for synthesising pharmaceutical ingredients. In agriculture, it supplies fertilisers and pesticides, enhancing crop yields and pest control. The automotive industry relies on the chemical sector for materials such as polymers, contributing to lightweight, fuel-efficient, and environmentally friendly vehicles.

It is pertinent to mention that there can be no transformation without chemicals. Take for example much-needed insulation panels and coatings necessary to reduce energy consumption in buildings, composite materials for wind turbine blades, electric batteries that extend the range of electric vehicles,

FIGURE 1: **Chemistry for Europe**



Source: Cefic (2023a)

and chemical recycling processes that can convert plastic waste back into chemicals. Chemicals are present in every strategic value chain (Cefic, 2023a).

The chemical industry is to undergo a double twin transition which also entails potential challenges:

1. *Going digital*: the integration of digital technologies, including big data, artificial intelligence (AI), robotics, and blockchain, coupled with a commitment to innovation, will enhance transparency and efficiency across all our processes, facilitating a seamless transition towards sustainability.

Embracing digitalisation also means potential cybersecurity threats, technology dependency and skills gaps, and supply chain vulnerabilities, amongst others.

2. *Climate neutral*: despite a commendable 60 per cent reduction in GHG emissions over the past 30 years, achieving climate neutrality in the chemical industry will require ground-breaking technologies, innovative approaches, and substantial changes in production processes. Shifting to climate-neutral production entails a massive demand for affordable and renewable energy sources, ensuring economic viability while transitioning to net-zero, implementing effective carbon capture and utilisation technologies, and so forth.

3. *Circular*: to minimise reliance on non-renewable resources in production, the chemical industry must prioritise the recyclability of materials. Accelerating waste recycling, utilising CO_2/CO as feedstock, and incorporating waste biomass into bio-based chemistry are critical steps towards fostering a circular and sustainable manufacturing ecosystem. Obtaining a diverse and sustainable supply of recycled or renewable feedstock, alongside ensuring investments to

develop and implement recycling technologies, with efficient waste collection and sorting systems alongside a shift in consumer behaviour and awareness, are just a few of the many challenges that the sector has to overcome to go fully circular.

4. *Safe and sustainable by design* (SSbD): the EU chemical industry aims to phase out the most harmful substances from consumer products unless deemed essential for society. Achieving this objective requires a substantial increase in research and innovation efforts to develop and introduce safe, sustainable chemicals to the market. SSbD requires, alongside others, significant investments in extensive research and innovation to develop new, safe, and sustainable chemicals. Developing accurate and comprehensive assessments is challenging, especially for emerging substances, scaling up the production of sustainable chemicals to meet market demands while maintaining cost competitiveness, and so forth.

Moreover, it needs to do so while remaining globally competitive so that the industry can continue supplying important EU value chains, including clean tech (Cefic, 2023a).

The industry also faces a labour shortage issue. More and more companies are struggling to fill vacant positions, finding that it can take nearly a year to recruit suitable candidates. The problem is even more acute for small and medium-sized enterprises (SMEs), where skills shortages were identified as a serious problem in a recent Eurobarometer study (2023). A dedicated Korn Ferry study (2018) predicted that if no active measures are taken on all political levels, the EU chemical industry will face an 11 per cent shortage in its workforce by 2030. If we translate this into numbers, it will mean more than 120,000 vacant positions that will not be filled. To meet market needs, swift and robust measures are required to boost the EU's potential while also considering third-country skilled nationals.

In addition, the need to reskill and upskill the existing workforce while emerging skills still need to be fully identified poses another obstacle for companies to ensure they can meet both the 2030 and 2050 climate goals. There is a need for swift measures to boost the local workforce, especially when it comes to acquiring science, technology, engineering, and maths (STEM) skills and attracting international talents to fill the vacant positions that the local workforce cannot cover.

ASSESSMENT OF THE EU'S CURRENT SITUATION AND EU INITIATIVES

The EU-27 is the second largest chemicals producer in the world, with €594 billion in sales in 2021. The chemical industry is also the fourth largest in the EU, accounting for around 7 per cent of manufacturing output by turnover (Cefic, 2023b). The industry directly employs 1.2 million highly skilled workers and supports 3.6 million jobs indirectly. It also supports a further 19 million jobs across all other value supply chains in the EU. The EU chemical industry has 67 per cent greater labour productivity than the average for the manufacturing sector. It supplies 90 per cent of key value chains (EC, 2023a).

The above-mentioned double twin transition poses multiple challenges when it comes to the workforce. The chemical sector faces a workforce shortage and difficulty hiring and retaining personnel. Several reasons for this have been identified by stakeholders, including:

1. The *lack of attractiveness* of the chemical sector: overcoming this challenge is crucial for successfully navigating the double twin transition. Improving the industry's image and showcasing its commitment to sustainability, digitalisation, and innovation will attract new talent and investments.
2. *Skills shortage*: bridging the scarcity is essential for implementing digital technologies, adopting sustainable practices, and meeting the demands of a rapidly evolving industry.
3. *Demographic change* (average age of employees is above 40 years old): if this problem is not solved, the lack of retention of expertise and knowledge transfer mechanisms to younger talent will endanger the industry's transformation.
4. *Reskilling and upskilling of the workforce*: these are paramount in aligning with the double twin transition. This includes training employees in new technologies, sustainable practices, and innovative processes, ensuring they are equipped to drive the industry's evolution.

Lack of attractiveness

'The chemical industry in general has "an ambivalent public perception"' (VCI & IGBCE, 2021). Even though the public's/consumers' perception somewhat recognises the innovative nature of the industry in providing solutions, it still associates the industry with residual risk classified as dangerous.

Another public perception study conducted by a group of researchers that analysed thousands of tweets in the span of a year concluded that, amongst others, a significant presence of chemophobia-related terms in the human activity topic, both in positive and negative classified tweets, persisted. (Guerris et al., 2020).

There is also a belief that such negativity applies to industry stakeholders, resulting in too few young

people choosing to learn the technical skills to work in this sector; it may also be why too few women are choosing to work in the industry (Cefic, 2023b).

One of the proposed solutions to the above problem is the European Chemical Employers Group's (ECEG) joint position paper on career guidance, with concrete proposals on partnerships between public authorities, education representatives, and parents to encourage young people from the age of 14 to consider energy-intensive industries for their future career paths (CEEMET & ECEG, 2023).

Skills shortage

The EU will need to recruit seven million more people, mainly from third countries, between now and 2030 to meet various challenges, from demographic ageing to the new 'green' and digital skills that are required (EC, 2023b) (see Figure 2).

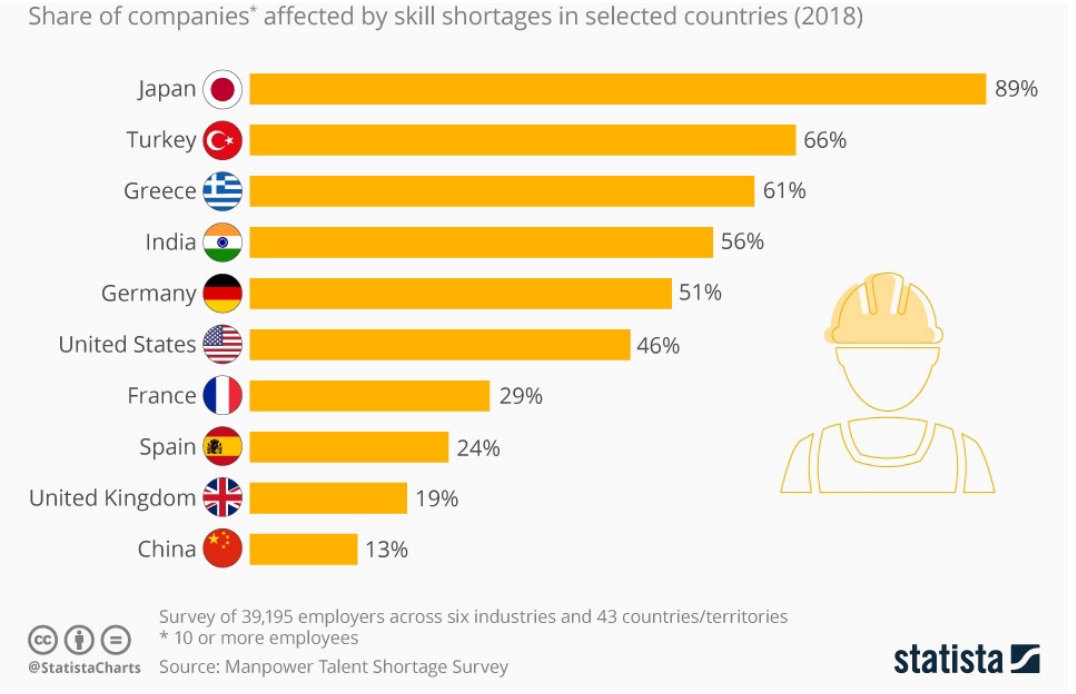
According to the 2021 labour shortages report by the European Labour Authority (ELA), STEM-related occupations are experiencing one of the highest concentrations of labour shortages (ELA, 2021). Only one in five young people graduate from STEM tertiary education every year, corresponding to fewer than two million graduates (Eurostat, 2023).

In France, for example, the chemical industry is experiencing recruitment difficulties for certain types of occupations, such as research and development (R&D); production at all levels (including production operators and managers); maintenance, especially technicians; logistics; sales technicians; and sales engineers (Pôle Emploi, 2023). The main reasons identified for the manpower shortage in the French chemical sector are the industry's and/or sector's lack of appeal, a mismatch between business needs and young graduate training, and the search for rare skills and highly skilled technical specialists.

To address this challenge, chemical businesses in France have adopted concrete strategies, including apprenticeship schemes, in-house promotion systems for operations management positions, recruitment drives, and partnerships with schools and training organisations (Katalyse & Boostrs, 2021).

Another solution to tackle the skills shortage is labour mobility. The European Commission proposed a legal migration policy, the New Pact on Migration and Asylum, on 27 April 2022 (EC, 2022a). According to Commissioner for Home Affairs Ylva Johansson, '[l]egal migration is essential to our economic recovery, the digital and green transition.' The Pact proposed to recast Single Entry and Long-Term Residence Directives. The former will ease the application process for residence and work by allowing

FIGURE 2: **The countries facing the greatest skill shortage**



Source: Statista, https://www.statista.com/chart/4690/the-countries-facing-the-greatest-skill-shortages/

lodge applications from both non-EU countries and EU Member States, whereas the latter will make it easier to acquire EU long-term residence status by simplifying the admission conditions, namely by allowing applicants to accumulate residence periods in different Member States (EC, 2022b).

A regulation establishing an EU Talent Pool, the recently adopted instrument (EC, 2023c) within the Pact on migration framework, includes, amongst others, a Communication on maximising the potential of talent mobility as part of the European Year of Skills and a Commission Recommendation on the Recognition of Qualifications of Third Country Nationals (EC, 2023b).

Demographic change

Labour shortages in the EU are already at record levels, with the declining working-age population being one of several contributing factors (EC, 2023d). Over the next 30 years, the EU's working-age population will shrink by almost 50 million people (EC, 2023e) (see Figure 3). The European Chemical Social Partners' project on demographic change in the chemical industry showed that the average age of employees across all Member States was above 45. This was considered the main cause of the skills and labour shortage in the sector, which saw most of its highly skilled employees retiring without an adequate replacement in place (Tivig, Eggert, & Korb, 2010) (see Figure 4).

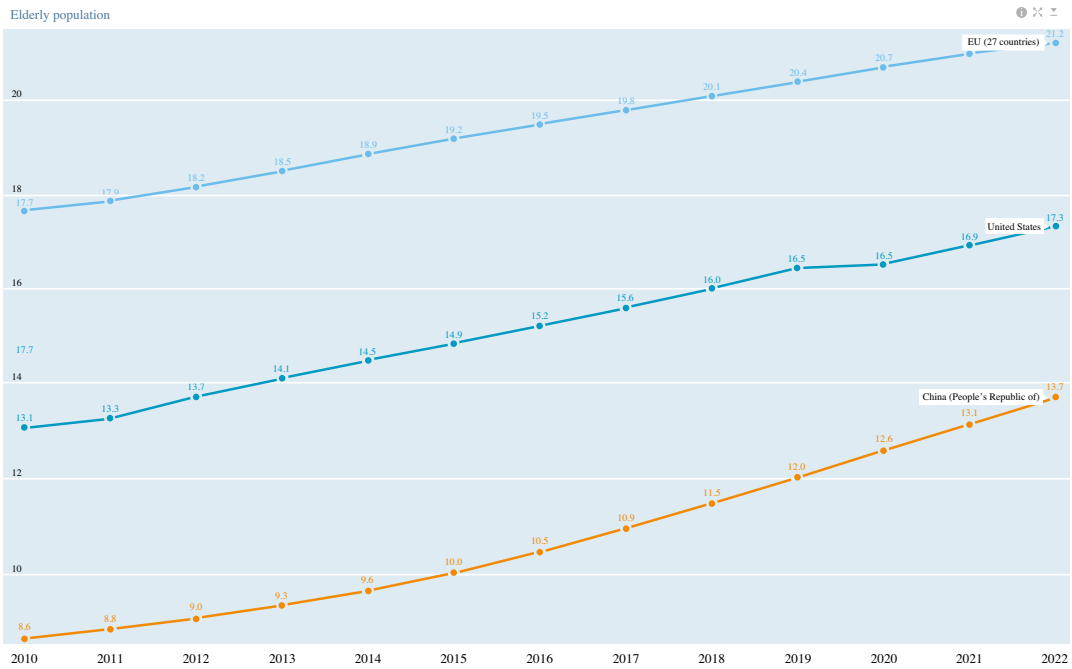
Increasing women's labour participation could be one of the most effective remedies to the negative consequences of population ageing (EC, 2023d), which resonates with the EU's employment rate target for 2030: one of the objectives of the 2021 Porto Social Summit is to halve the gender employment gap by that date compared with 2019 (European Council, 2021).

Reducing inactivity rates in Europe by agreeing on EU and national employment rate targets could be another solution for tackling the ageing population issue. Here, the European Commission can play an important role in supporting the EU Public Employment Services Network's cooperation with private employment services across Europe, as well as between employment services and social services. National specificities and practices should always be taken into account while proposing potential actions (BusinessEurope, 2023).

Reskilling and upskilling

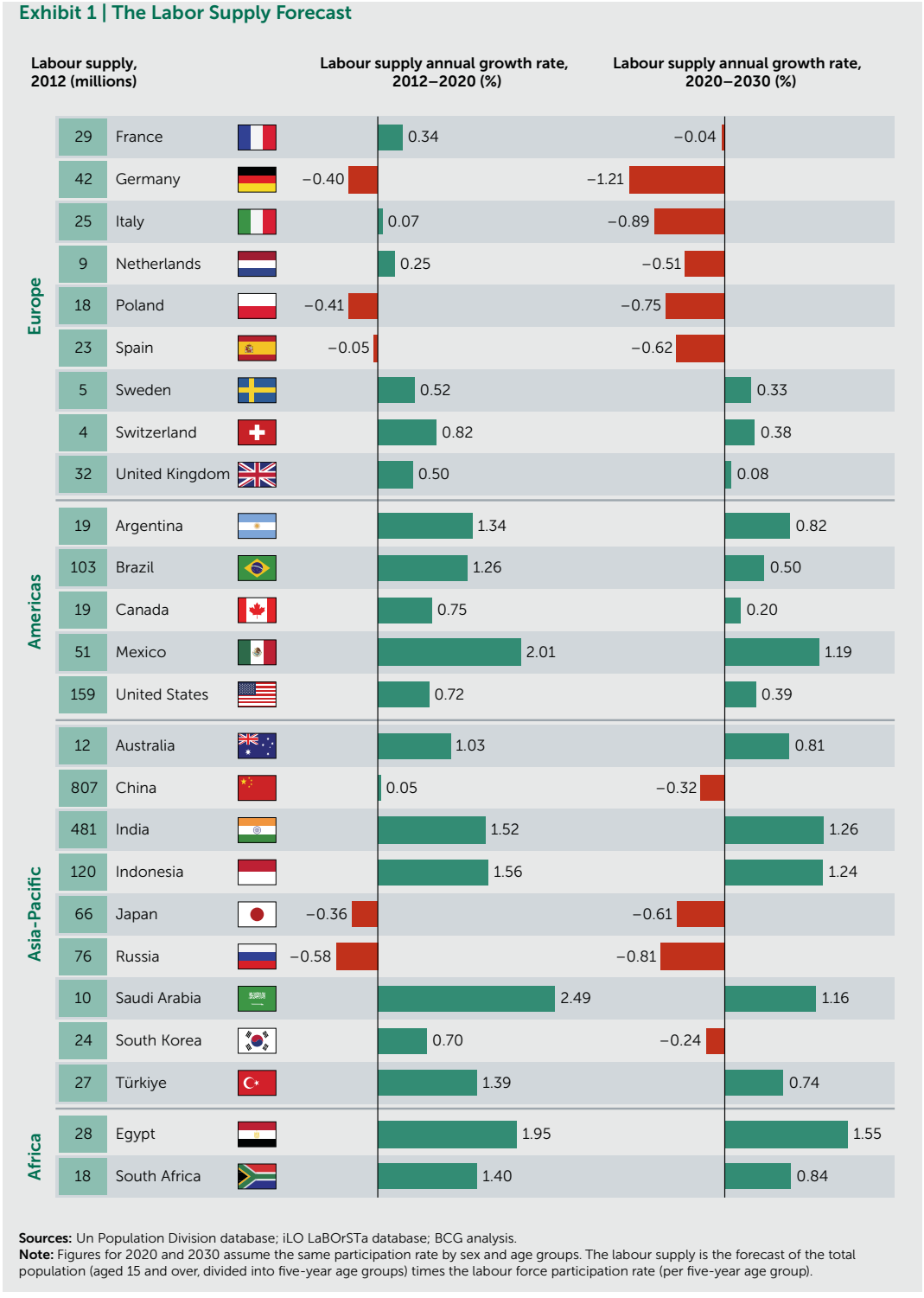
Reskilling and upskilling issues are multifaceted. There is a need for frequent analysis/skills intelligence to identify the current workforce needs in re/upskilling, the required skills, and the main stakeholders to provide the necessary training.

FIGURE 3: **Elderly population total, % of population, 2010–2022**



Source: OECD Labour Force Statistics 2023, https://data.oecd.org/pop/elderly-population.htm#indicator-chart

FIGURE 4: **The global workforce crisis, 10 trillion at risk**



Sources: Un Population Division database; iLO LaBOrSTa database; BCG analysis.
Note: Figures for 2020 and 2030 assume the same participation rate by sex and age groups. The labour supply is the forecast of the total population (aged 15 and over, divided into five-year age groups) times the labour force participation rate (per five-year age group).

Source: BCG, https://www.bcg.com/publications/2014/people-organization-human-resources-global-workforce-crisis

Other potential challenges include a) constantly evolving skills, where rapid changes in technology and job requirements mean that the skills needed today may differ from those in demand tomorrow (HR Forecast, 2021); b) the digital divide, where access to digital technologies and online learning platforms is not always available and/or uniform across the EU (European Data, 2022); c) resistance to change, particularly if it involves adopting new technologies or altering established work practices; and d) a shortage of trainers and instructors, where the demand for skilled trainers and instructors may outstrip the available supply. Recruiting and retaining qualified professionals to deliver reskilling programmes is a challenge that needs attention (EC, European Education Area, 2023).

The industry, alongside other stakeholders, has already proposed several solutions, but more needs to be done.

Transition Pathways for the Chemical Industry identified the need to re/upskill the workforce especially in the technical, digital/IT fields, research and innovation, production, logistics, chemical safety, and chemical regulation. Specific attention should be given to training university students on the regulatory and safety aspects of the chemical industry (EC, 2023a).

Solid vocational education and training systems, of which SMEs are an integral part, that foster the re/upskilling of industry workers is one key element of the solution, in combination with ambitious employment and industrial policies (industriAll European Trade Union, 2021).

Social partners (employers and trade union representatives) at all levels can help secure a skilled European workforce by updating curricula and qualifications. For the chemical sector, ECEG, together with its EU-funded project partners, has developed a sector-specific curriculum framework on digital skills for workers, employers, managers, and academia, respectively (ECEG, FECCIA, & Ledarna, 2022). On the national level, the German Social Partners in the chemical sector, the German Federation of Chemical Employers' Associations (BAVC), and the Mining, Chemical and Energy Workers' Union (IGBCE) developed 'The Future Skills Report', analysing around 200,000 job profiles across the EU, United States, and China using AI and big data. Not only the top jobs and skills that are in demand in the sector were identified, but also the key trends in terms of skills shortages that can emerge if the demand is not sufficiently addressed (BAVC, IGBCE, & HR Forecast, 2021).

The Chemskills Erasmus + Blueprint project is another EU-funded project designed to respond to the chemical industry's current challenges by developing green and digital skills alongside competencies to produce 'safe and sustainable chemicals by design'. The objective is to identify gaps between industry needs and current curricula (ECEG, 2023).

POLICY RECOMMENDATIONS

The double twin transition requires support and cooperation at all levels to allow the chemical industry to succeed in sustainable growth, development, and innovation while staying competitive and meeting the 2030 and 2050 climate targets. The number of stakeholders involved is large, and the lack of coordination is the main hindrance for an orchestrated response. Joint actions instead of reactions are urgently needed.

One of the best practice examples of multistakeholder cooperation is Chemelot, a sustainable and competitive industrial park with nearly 150 institutions and companies in the Netherlands.[1] It combines R&D on the campus and production at the industrial park. Embracing cross-sectoral collaboration, similar to the Chemelot model, can further enhance industry success by leveraging the strengths of multiple sectors to drive sustainable innovation and economic growth.

When it comes to the political realm, a swift and transparent exchange between the EU and Member States is needed. Implementing strategies, especially related to skills and competences which are beyond EU areas of action, is a national prerogative.

In this context, an EU-wide STEM strategy should be considered, where the European Commission could promote annual or bi-annual STEM market analysis to identify the STEM labour gap and unemployment in STEM occupations, and/or calculate non-academic STEM occupations for the upcoming years (ECEG & industriAll Europe, 2022). The strategy should include a qualitative assessment of skills needed in emerging fields such as AI and renewable energy. Combining quantitative and qualitative analyses will guide targeted educational initiatives, addressing both immediate gaps and evolving industry needs.

In addressing employment and skills-related issues, social partners excel in handling sector-specific challenges. Their unique position enables them to not only provide sector-specific data but also formulate targeted solutions to meet transition goals. A more prominent role for social partners and capacity building (where required) to strengthen social dialogue is needed to enable the successful transformation of the industry.

In terms of third-country workforce integration, social cohesion is essential. Policies that will

promote inclusion, intercultural dialogue, and diversity are key.

As we approach the EU elections, a concerted effort is required from political leaders to secure the EU's strategic autonomy. This involves implementing tangible measures to secure and retain a skilled workforce; providing incentives to companies, particularly financial support for SMEs for ongoing reskilling initiatives; and facilitating workforce migration within the EU or from outside the EU.

Establishing a robust policy evaluation mechanism and conducting periodic assessments of workforce development, industry transformation, and climate goal impact can be a benefit here. Implementing a feedback loop will ensure adaptability and continuous improvement, fostering a dynamic and responsive policy framework.

NOTE

1. https://www.chemelot.nl/chemelot-en/organisation.

REFERENCES

BAVC, IGBCE, & HR Forecast. (2021). 'The Future Skills Report', 2 March. https://future-skills-chemie.de/en/.

BusinessEurope. (2023). 'Towards an EU Action Plan to Address Labour and Skills Shortages', 27 June. https://www.businesseurope.eu/sites/buseur/files/media/position_papers/social/2023-06-27_statement_eu_action_plan_labour_skills_shortages.pdf.

CEEMET & ECEG. (2023). 'Position Paper on Career Guidance', 23 January. https://www.eceg.org/_files/ugd/977a5c_a88010a4c5c94196a2e836d6b07e0267.pdf.

Cefic. (2023a). 'The EU Chemical Industry Transition Pathway'. https://transition-pathway.cefic.org/.

Cefic. (2023b). 'The European Chemical Industry Facts and Figures 2023', 23 February. https://cefic.org/app/uploads/2023/03/2023-Facts-and-Figures.pdf.

Cefic. (2023c). 'How Can Europe's Chemical Industry Help Deliver on the Green Deal?' https://cefic.org/app/uploads/2020/06/Chemicals-for-the-Green-Deal-Brochure.pdf.

Cefic. (2023d). 'Landscape of the European Chemical Industry'. https://cefic.org/a-pillar-of-the-european-economy/landscape-of-the-european-chemical-industry/.

EC (European Commission). (2019a). 'Annex: Roadmap and Key Actions', 11 December. https://ec.europa.eu/info/files/annex-roadmap-and-key-actions_en.

EC (European Commission). (2019b). 'The European Green Deal', 11 December. https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6691.

EC (European Commission) (2022a). 'New Pact on Migration and Asylum', 27 April. https://ec.europa.eu/info/strategy/priorities-2019-2024/promoting-our-european-way-life/new-pact-migration-and-asylum_en.

EC (European Commission). (2022b). 'Legal Migration: Attracting Skills and Talent to the EU', 27 April. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2654.

EC (European Commission). (2023a). 'Transition Pathways for the Chemical Industry'. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs Directorate F – Ecosystems I: Chemicals, Food, Retail Unit F.2 – Bioeconomy, Chemicals & Cosmetics, January. https://single-market-economy.ec.europa.eu/sectors/chemicals_en.

EC (European Commission). (2023b). 'European Year of Skills'. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en.

EC (European Commission). (2023c). 'Regulation Establishing an EU Talent Pool'. Migration and Home Affairs, 15 November. https://home-affairs.ec.europa.eu/regulation-establishing-eu-talent-pool_en.

EC (European Commission). (2023d). 'Demographic Change in Europe: A Toolbox for Action', 11 October. https://commission.europa.eu/publications/demographic-change-europe-toolbox-action-factsheet_en.

EC (European Commission). (2023e). 'The Impact of Demographic Change in a Changing Environment', 17 January. https://commission.europa.eu/system/files/2023-01/the_impact_of_demographic_change_in_a_changing_environment_2023.PDF.

EC, European Education Area. (2023). 'Education and Training Monitor 2023'. https://op.europa.eu/webpub/eac/education-and-training-monitor-2023/en/comparative-report/chapter-6.html.

ECEG. (2023). 'Chemskills: Enabling the Green and Digital Skills Transformation of the Chemical Industry'. Erasmus + Blueprint project. https://www.linkedin.com/company/chemskills-project/.

ECEG, FECCIA, & Ledarna. (2022). 'Identifying and Meeting Digital Skills Needs in the European Chemical, Pharmaceutical, Rubber, and Plastics Industry', October. https://www.eceg.org/_files/ugd/977a5c_ee6a7fbb75eb4aa98e3520c5a1d2e20a.pdf.

ECEG & industriAll European Trade Union. (2022). 'Europe Needs to Make Its STEM Strategy a Reality Now', 13 May. https://www.eceg.org/_files/ugd/977a5c_41fb74335b384171bfa217e0ad22c935.pdf.

ELA (European Labour Agency). (2021). 'Report on Labour Shortages and Surpluses', November. https://www.ela.europa.eu/en/media/725.

Eurobarometer. (2023). 'SMEs and Skills Shortages', 14 November. https://europa.eu/eurobarometer/surveys/detail/2961.

European Council. (2021). Porto Social Summit, 7 May. https://www.consilium.europa.eu/en/meetings/european-council/2021/05/07/social-summit/.

European Data. (2022). 'Towards 2023: The European Year of Skills', 22 November. https://data.europa.eu/en/publications/datastories/towards-2023-european-year-skills.

Eurostat. (2023). 'Students Enrolled in Tertiary Education by Education Level, Programme Orientation, Sex, Type of Institution and Intensity of Participation', 10 November. https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_enrt01/default/table?lang=en.

Guerris, M., Cuadros, J., González-Sabaté, L., & Serrano, V. (2020). 'Describing the Public Perception of Chemistry on Twitter'. Chemistry Education Research and Practice, 14 May. https://doi.org/10.1039/C9RP00282K.

HR Forecast. (2021). 'Future Skills and Trends in the Chemical Industry', 17 November. https://hrforecast.com/future-skills-and-trends-in-the-chemical-industry/.

industriAll European Trade Union. (2021). 'Just Transitions Need Strong Reskilling and Upskilling Strategies: Europe's Pact for Skills One Year On', 9 November. https://news.industriall-europe.eu/Article/670.

Katalyse & Boostrs. (2021). 'Cartographie des métiers et des compétences incluant un focus sur le risque d'obsolescence des compétences et métiers en tension dans la branche chimie', 9 December. https://www.francechimie.fr/media/633/opco2i-branche-chimie-katalyseboostrs-rapport-091221.pdf.

Korn Ferry. (2018). 'Future of Work Talent Crunch'. https://www.kornferry.com/content/dam/kornferry/docs/pdfs/KF-Future-of-Work-Talent-Crunch-Report.pdf.

Pôle Emploi. (2023). 'Nombre de projets de recrutement en 2023 par Métier Secteur: Industrie chimique, pharmaceutique

& raffinage'. https://statistiques.pole-emploi.org/bmo/bmo?fg=CE&le=0&pp=2023&ss=1.
Tivig, T., Eggert, D., & Korb, C. (2010). 'The Impact of Demographic Change in the Chemical Industry in Europe'. From a joint project by ECEG, EMCEF, FECCIA, funded by the European Commission. http://www.demographicsinchemistry.eu/fileadmin/pdf/Chemiestudie_en.pdf.
VCI & IGBCE. (2021). 'The Chemical Industry in the Public Eye: Between Devil's Work and Solutions', 29 January. https://www.vci.de/vci/downloads-vci/publikation/broschueren-und-faltblaetter/rheingold-study-the-chemical-industry-in-the-public-eye-between-devils-work-and-solutions.pdf.

Greening Industries, Reviving Sovereignty: A Boundary for Sustainable Finance?

Cedric Merle

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

Sustainability and geopolitics have collided due to the COVID-19 pandemic and Russian belligerency. Economic affairs are increasingly polarised by ideologies.[1] Henceforth, how can sustainable finance stand out? It could be viewed with contempt, disdain, or disapproval should its market players dismiss or mishandle domestic content rules and industrial policies. A cultural shift is at stake, as geopolitics usually do not fall within their remit. The EU policy framework must be reformed so as to facilitate the identification and financing of investee firms supporting the EU's industries, sustainability, and sovereignty, all at once.

ABOUT THE AUTHOR

Cedric Merle is a sustainable banking professional and lecturer. He leads a team dedicated to content, methodological innovation, regulatory intelligence, and greenwashing prevention, altogether in the context of financial transactions. His work includes social bonds, strategic autonomy, and the transition of brown industries. He studied law, public affairs, and sustainability and holds a PhD in political ecology with Chinese characteristics.

WEANING THE EU OFF UNDESIRABLE DEPENDENCIES

Executives and decision-makers are now prioritising security across health, energy,[2] food, and territorial integrity. Such a shift towards supply security may derail climate change action when it leads, for instance, to increased liquefied natural gas (LNG) imports or to the postponement of coal phase-out timelines. In contrast, the search for energy security, when pursued through demand-side management or support to renewable or nuclear energy, can fast-track decarbonisation (Merle & Davasse, 2022).

The 'carbon maths' of energy decoupling from Russia has not yet been completed.[3] According to the International Energy Agency (IEA), the decline in gas demand in the EU in 2022, the steepest and most geopolitically based in history (a 13 per cent drop in a single year), was partially achieved through climate-beneficial measures (grants and preferential loans for housing retrofits and heat pump installations, alongside behavioural change campaigns) (IEA, 2023), while other substitutes were detrimental (gas-to-oil switching, or production curtailment substituted by imports of finished products from outside the EU). Assessing the net effects of the EU's energy responses to Russia's aggression on the delivery of its climate pledge is complex, especially in the long run.

This collision was sparked by the COVID-19 pandemic.[4] This clash is now being further fuelled by an enduring total war in Europe's backyard. The EU is deeply committed to an end to the Russian shelling and should work towards this outcome *whatever the financial cost*. However, this mutating shock unveiled the EU's dependencies and vulnerabilities. Plunging ammunition inventories recall the shortages of respirator stockpiles encountered during the pandemic.

SELF-SUFFICIENCY ILLUSIONS

Trade and supply chains are being increasingly weaponised. Commercial affairs are hammered and polarised by political values and ideologies[5] are overtaking economic interests. The events of the early 2020s are highlighting the need to beef up industrial and sovereignty policies at the European bloc level. Nevertheless, dependencies are not mechanically equal to vulnerabilities. It all depends on what those dependencies are and vis-à-vis whom. If reciprocal and limited in scope, dependencies can be endurable. They can even lubricate international cooperation, including on climate change. Beyond allowing tenuous reciprocal decarbonisation pledges, 'trade in renewable energy goods is a global public good' (García-Herrero, Grabbe, & Källenius, 2023).[6] Moreover, the very notion of domestic is not always straightforward. The EU is confronted with a dilemma between 'made in' the EU and 'made by' EU firms. Should its officials aim at the manufacturing of decarbonisation equipment in Europe, and if so, regardless of the firms' citizenship? Or should the EU favour manufacturing by European firms, notably from overseas,[7] and would that secure a supply? In that case, how can situations abroad be differentiated (e.g. imports from a like-minded and reliable trade partner versus an autocratic and volatile regime)? How can policy-makers also deal with heterogeneous sector-level integration and multi-layered supply chains? The manufacturing conditions also matter, and pertain, for instance, to the carbon intensity or working conditions. In a nutshell, does who produces the goods matter more than where the goods or their parts are produced, or is how the goods are produced also important?

With the 'how' criteria, one mantra of policy-makers is to harmonise the definitions of sustainability to combat greenwashing and prevent market fragmentation. If successful, this should lower information and analytical costs, ultimately allowing cross-border environmental, social, and governance (ESG)/sustainable financing flows. Nonetheless, definitions of sustainability might also be weaponised for sovereignty purposes, especially when taxonomies of green activities are not science-based (De Souza, & Merle, 2023).

THE NEED FOR DELINEATION

Strategic autonomy is not self-sufficiency, nor is it autarky.[8] It must be targeted towards critical sectors, technologies, or feedstock that underpin the fulfilment of vital needs or the continuity of critical infrastructures such as water, power, or communication utilities.[9] Industries are currently too loosely defined by the EU and the proliferation of alliances is counterproductive. Industries are referred to here as refining, processing, and manufacturing activities, which are positioned at midstream parts of value chains (automobile parts, metals processing, etc.).[10] The lack of autonomy is a scourge, but an unbridled attempt by the EU to become self-reliant in everything would only weaken its legitimacy.[11] It would dent the living conditions of its citizens and make the green transition unaffordable.[12] This policy trend, called 'homeland economics' (*The Economist*, 2023), attempts to reduce risks 'presented by the vagaries of markets, an unpredictable shock such as a pandemic, or the actions of a geopolitical opponent'. Industrial policies desperately need delineation and consistency with other policies.

THE ADAPTABILITY RECIPE

Strategic autonomy can be pursued by securing access through long-term contracts, stockpiling, partner diversification, and circularity. It begins with reducing overseas dependencies and then wisely consenting to the non-substitutable ones. Enlightened consent requires a thorough selection of suppliers. If de-risking and partial decoupling from China is necessary (although this cannot be asserted too loudly),[13] such geostrategic proofing de facto excludes the United States as well. The quest for autonomy aims at de-risking, not decoupling, the EU's energy transition from unreliable trade partners and rebalancing non-reciprocal relations. Ironically, it is occurring while Western investors are increasingly exposed to Chinese securities.[14] Trade and ecological transition partners should ideally be chosen based on like-mindedness, geographic proximity, historical reliability, and the aversion of the counterparts to weaponising ties in daunting situations. Lean manufacturing should be superseded by flexible manufacturing anchored in elastic vertical integration. The EU's economy lacks the adaptability to step up production in case of shortages or extreme weather events. Such production patterns involve maintaining know-how and mothballed capabilities, possibly at an economic loss, outside tumultuous periods, requiring proper training policies, contractual arrangements, price incentives, and de-risking schemes.

EUROPEAN LEADERSHIP IN SUSTAINABLE FINANCE

Sustainable finance is an area in which the EU is a pioneer.[15] This segment represents a transformation of the entire financial system.[16] The Union is a global standard setter in the domain, most

notably through its comprehensive and refined classification of sustainable activities (its so-called taxonomy)[17] or updated sustainability disclosure regime applicable to more than 50,000 firms (the Corporate Sustainability Reporting Directive – CSRD). Its all-encompassing regulatory package is a source of inspiration thanks to its ambition, sophistication, and granularity, but it is also a source of concern due to its extra-territorial effects and lack of usability. In parallel, the EU began to truly pursue industrial policies aiming at building up domestic capabilities and curtailing strategic shortcomings in the aftermath of the COVID-19 pandemic and the invasion of Ukraine, thereby raising consistency challenges in its policy mix.

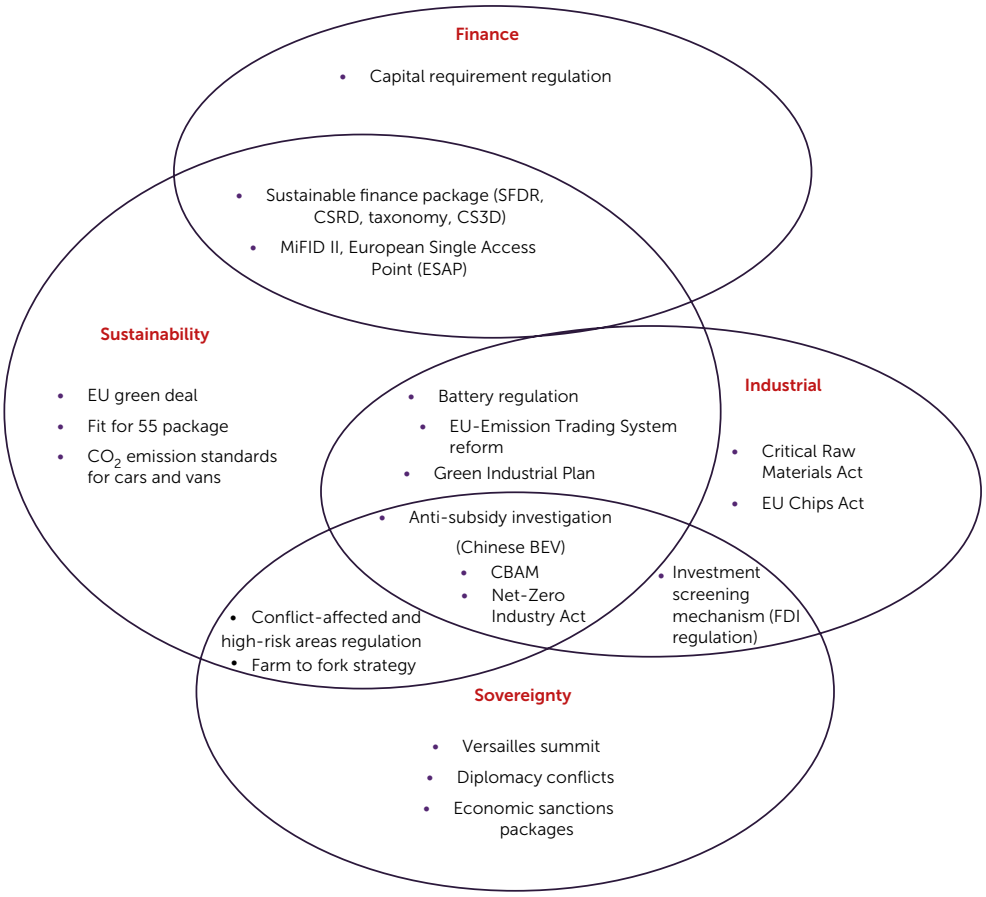
CONSISTENCY BETWEEN POLICIES

This wake-up call regarding the EU's dependencies came in the context of not only the technological and trade war between China and the United States but also the mainstreaming of sustainable finance policies in the EU. How can EU policy-makers articulate sustainability, geopolitical, industrial, sovereignty, and sustainable finance policies? Aligning this policy mix is a conundrum. Can financial actors handle these multifaceted and often competing priorities? How can policy-makers help them not feel torn apart?

Sustainability policies encompass policy orientations or objectives such as the European Climate Law, the 'Fit for 55' package,[18] and the Green Deal, as well as the inclusion of sustainability criteria and conditionalities in other policies (common agriculture policy, trade policy, etc.).

The Carbon Border Adjustment Mechanism (CBAM), tied to the reform of the EU Emissions Trading System, is the most emblematic attempt to articulate trade, industrial, and carbon pricing policies. Squaring this circle is a complex process (see Figure 1). Sustainable finance policies on the one hand, and industrial policies on the other, are inadequately articulated yet closely intertwined.[19]

FIGURE 1: **The crossroads of finance, sustainability, industrial, and sovereignty policies**



If sovereignty policies are added,[20] synergies are clearly lacking. Criteria must be at least compatible if not already cross-cutting.

Sustainable finance protagonists have begun to deal specifically with industrial challenges through self-regulation and market-led initiatives such as the Net Zero Banking Alliance (NZBA), which spans nine carbon-intensive sectors, mostly industrials.[21] Regulators have been outpaced by private actors. They must pursue a seamless policy mix, with more consistency, intertwinement, and interdependency, increasing the porosity between policies.

RISKS OF MARGINALITY

Sustainable finance is today at risk of being overshadowed by warfare and more ballot-sensitive concerns (e.g. immigration or purchasing power issues). Its protagonists must learn to cope with industrial policies and domestic content requirements. The latter are not limited to schemes such as the Net Zero Industry Act (NZIA) but also include non-green activities.[22] This is why its market players must move beyond their usual remit, and policy-makers need to adapt to this cultural shift. Boundary integration could enrich a mandate whereby industrial and geopolitical considerations hold greater sway.[23] To stay abreast of modern politics and economics, sustainable finance actors must also alter their views on the defence sector.[24] They can no longer hide behind the argument that sovereignty matters do not fall within their mandate.[25] There is no sustainability without free elections and no self-determination without proper defence capabilities. ESG actors must cross boundaries and cannot remain sectorally and geopolitically agnostic.

Overall, very few funds are anchored in the industrialisation of Europe or economic federalism. One can mention CPR AM, which in March 2023 launched a fund called CPR Invest European Strategic Autonomy, notably exposed to industrial,

TABLE 1: **Strategic framework for enhancing EU policies and financial mechanisms**

EU rules, competencies, and initiatives	1. Amend competition rules and relax the state aid regime[29]
	2. Defend intellectual property against theft and undertake massive research efforts
	3. Launch EU-wide stockpiling of critical raw materials, secure long-term supply contracts (including through offtake schemes),[30] and undertake joint procurement
	4. Streamline industrial alliances and increase fiscal capabilities
	5. Foster a sustainable defence policy underpinned by a common industrial basis and joint procurement; develop sustainability criteria tailormade to the sector (while lifting research and development barriers between defence and civilian applications)[31]
	6. Unionise sustainability and industrial policies: fill the accountability and representativeness gap. Industries are often labour intensive and historically centred around workers' unions, yet ESG actors have been deaf to trade unions; such actors must talk to each other
EU spending and financial intervention	7. Adjust the European Investment Bank's mandate to enable further lending to green or greening industrials, taking into account sovereignty criteria
	8. Strengthen the EU's foreign direct investment attractiveness by offering location-based subsidies for newly established manufacturing capabilities (offensive and opportunistic), but also for already located (defensive) and repatriated ones (offensive and less cooperative)
	9. Support the issuance of labelled bonds (green, social, sustainability-linked) from European industrials or for green proceeds allocated in Europe, through technical assistance and fiscal incentives[32]
	10. Adjust the sectoral composition constraint of the EU's climate index benchmarks (overweighting industrials in PAB CAB, beyond high-stakes sector rules)[33]
Standard setting, tools, and methodologies aimed at private actors	11. Extend the EU's sustainable finance taxonomy for 'industries'[34] (adding new eligible activities, with technical screening criteria for mining) and deepen international cooperation on the classification of sustainable activities (ensuring a first-mover global position in standard setting, with potential interplay with CBAM)[35]
	12. Launch an EU methodological initiative on scope 4 emissions to award and encourage emission avoidance from industrials (creation of accounting/standard setting principles, assigned possibly to the European Financial Reporting Advisory Group)[36]
	13. Develop a list of like-minded countries and publish a reliability index of jurisdictions, inspired by the existing conflictuality index,[37] to provide official guidance for friend-shoring strategies
	14. Support the adaptation of the Herfindahl Hirschman Index (HHI) at corporate level to assess vulnerability (extrapolated, when relevant, from the CRMA)[38] and develop a firm-level declination of the NZIA (allowing for the tracking of companies' contributions to the EU aggregate target)[39]
	15. Create an EU financial label on strategic autonomy built on a co-benefit tracker (extending the EU's 'do no significant harm' approach to other political priorities)

food, health, and defence stocks;[26] or Go Local, a fund launched by LFDE which invests in international companies aiming to address the global challenge of meeting essential autonomy needs (La Financière de l'Echiquier, 2023). Apart from the defence sector, out of a sample of 3,500 EU public equity funds, industrials accounted for 17 per cent of the composition, roughly equal to their average weight in GDP. Interestingly, this share of industrials is much higher for Article 8 and Article 9 funds (i.e. funds marketed as sustainable as per the EU's Sustainable Finance Disclosures Regulation – SFDR – classification). This entails that a higher exposure to industrials is at least correlated to a sustainable investing thesis. Nonetheless, biases, also called tilting, must be formalised and further assumed, for instance by introducing minimum exposure targets to these sectors, and heightened engagement must be pursued.[27] This is all the more true as industries, especially the heavy and hard-to-abate ones, are the missing jigsaw pieces to achieving net-zero emissions.

***

The conclusions here are anchored in a few compelling and shaping facts: without metals, there will be no transition; without affordable and abundant low-carbon electricity, there will be no green (re)industrialisation; without advanced skills and research, there will be no competitive edge and technological breakthrough; without adjustments to competition and concentration rules, there will be no advent of industrial champions in Europe; without social support to workers and customers at risk, there will be no political and societal consensus on the low-carbon transition.

For EU officials, there is a ridgeline between market-based mechanisms and political meddling, between incentives and interference. Investee firms that contribute to the threefold goal of supporting the EU's industries, sustainability, and sovereignty must be more easily identified and financed without triggering retaliation from foreign powers. EU private financial and non-financial firms will feel overwhelmed by a threefold agenda that includes extending the EU from Lisbon to Luhansk,[28] de-risking our economy and energy transition from China, and more than halving greenhouse gas emissions by 2030. Table 1 identifies current EU policy pitfalls and proposes reforms to the EU sustainable finance framework while helping businesses to curb dependency on unreliable and politically adverse trade partners. It offers implementation guidance for the NZIA and Critical Raw Materials Act (CRMA). Some proposals lay out a broad framework that may be used by a more widespread audience to navigate the ongoing geostrategic transition.

NOTES

1. The standoff between political ideologies is explicitly theorized, assumed, and pursued by authoritarian rulers who despise liberal ideas, societies, and democracies. In response, the EU officially set a priority around 'Promoting our European way of life, Protecting our citizens and our values'.
2. This tension between ambivalent goals is superbly illustrated through the name of the United Kingdom's recently created Department for Energy Security and Net Zero.
3. Preliminary findings state that '[c]lean energy transitions have accelerated amid security concerns' (IEA, n.d.). Food security also matters as the dependency on Russian gas has disrupted agriculture due to fossil-fuel-derived nitrogen fertilisers and pesticides.
4. This expression appeared in protests following the yellow vests movement in France. It is also inspired by Gollier (2022).
5. The stand-off between political ideologies is explicitly theorised, assumed, and pursued by authoritarian rulers who despise liberal ideas, societies, and democracies. In response, the EU officially set a priority around 'Promoting our European way of life, protecting our citizens and our values'.
6. Quote: 'Trade in renewable energy goods is a global public good; all countries gain when others cut emissions, and all suffer from climate change if decarbonisation is delayed. Yet this trade depends on China, which controls most of the world's production of solar panels and electric vehicle batteries, and some of the global trade in wind turbines. These supply chains are vulnerable to disruption, natural disasters and weaponisation by China, which has already exercised its dominant position in some critical raw materials to put pressure on other countries.'
7. Provided such firms' citizenship can be defined. Determining a firm's nationality is fraught with many limitations: a multitude of criteria can be factored in, including their headquarters location, shareholders' geographical mix, capital structure, location of research and development centres, manufacturing facilities, or workforce, geographical footprint of their customer base, and others.
8. Steinbach (2022) defines the concept as an umbrella for policies that protect, provide, and project. It 'protects by ensuring self-sufficiency and less reliance on foreign governments; provides by shoring up domestic economic and political conditions; and projects by promoting developments internationally that are conducive to EU interests and values'. The author identifies 'three motivational categories: (i) the furtherance of European values, with a particular emphasis on sustainability; this includes the aspiration to structure geopolitical relations in line with the EU's value priorities; (ii) to promote European economic interests, including defensive actions to prevent unfair competition, as well as offensive coercive and unilateral action; and (iii) the desire to ensure security, not only in the military and defense domain, but also when it comes to undue economic or technological dependence on foreign powers'.
9. The EU sets the following target for 2030 in the context of the Net-Zero Industry Act (NZIA): wind turbine manufacturing in the EU to meet a minimum of 85 per cent of the wind annual deployment needs within the EU, solar PV 40 per cent, heat pumps 65 per cent, batteries 85 per cent, and electrolysers 50 per cent.
10. Such industrial activities often require heat; their end products are tangible outputs (e.g. steel, iron, capital goods, equipment).
11. Dependencies on non-critical goods must not be resorbed at any cost; for instance, flight simulators, decorative plants, and garden furniture, for which France is highly dependent, are *no*t strategic (Bonneau & Nakaa, 2020).
12. The alleged negative effects of a fragmented world

economy are additional costs (end of the dogma 'anything that can be manufactured cheaply must be produced elsewhere'), overcapacities (contrary to the principle of the global division of labour), and decline of pacifying trade (increased risk of escalation and conflict).

13. See Canfin (2023): 'Because our goal is of course not to replace our current dependence on Russian, Qatari or Saudi fossil fuels by another dependence on China.'

14. Western investors are exposed to Chinese equity investments through global financial indices (e.g. MSCI EM indexes).

15. Sustainable finance policies go beyond mere ESG integration and exclusion filters by integrating a contributive angle (the 'in–out' as per the double materiality model, with a focus on maximising positive impacts and providing solutions). The area is regulation-rich, with TR, SFDR, and CSRD famous legislation acronyms. It also relates to a suite of labelled financial instruments (including green, social, sustainability, and sustainability-linked bonds).

16. Sustainable finance is officially defined by the EU as 'finance to support economic growth while reducing pressures on the environment to help reach the climate- and environmental objectives of the European Green Deal, taking into account social and governance aspects'. It encompasses market practices, labelled financial instruments, actors, and ad hoc methodologies, but also a highly heterogeneous set of rules, from principle-based self-regulation to hard law requirements. It is a *segment transformation*. In some respects, it is a sub-industry which grows in relative and absolute terms (a segment) but which also alters its overarching industry and system (a transformation). Indeed, the bulk of its features complement mainstream financial components (e.g. a green bond is first and foremost a bond, a climate risk assessment is a risk assessment, etc.).

17. Regulation on the establishment of a framework to facilitate sustainable investment.

18. The 'Fit for 55' package is a set of proposals to achieve the EU 2030 climate goal. It includes legislations on the EU Emissions Trading System; effort-sharing regulation; land use and forestry; alternative fuels infrastructure; Carbon Border Adjustment Mechanism; Social Climate Fund; RefuelEU aviation and FuelEU maritime; CO_2 emission standards for cars and vans; energy taxation; renewable energy; energy efficiency; and energy performance of buildings.

19. The energy transition is an opportunity to improve the trade balance of the EU by lowering imports of fossil fuels. Nonetheless, the cost of the latter should not be replaced by the cost of equipment such as electrolysers, wind turbines, and so forth.

20. Sovereignty policies are defined as efforts to reduce dependencies on external partners or suppliers and minimise the risk of shortages arising from potential embargo, trade war, or geopolitical blackmail.

21. The guidelines are specific to nine carbon-intensive sectors: agriculture, aluminium, cement, coal, commercial and residential real estate, iron and steel, oil and gas, power generation, and transport. Decarbonisation pathways, paces, and tools must be adapted to sectoral specificities for proper implementation.

22. The Inflation Reduction Act (IRA) and the NZIA, respectively in the United States and in the EU, epitomise policies aimed at supporting domestic green industries. Similar schemes exist elsewhere, for instance in India (production-based incentives for solar PVs and batteries) or South Korea (K-Chips Act with tax breaks on semiconductors).

23. In the sense of factoring in geostrategic considerations fraught with risks of trade, normative, or military showdowns, with their subsequent supply chain disruptions, embargos, tariffs, or sanctions.

24. Defence stocks are often excluded from ESG or sustainability funds although some of the exclusions relate to specific armaments (e.g. cluster ammunitions). Systematic exclusions are gradually being replaced by revenues thresholds, with nuanced criteria accommodating sovereignty concerns (export rules, business ethics). Recall that the presence of the defence industry in the stillborn social taxonomy was intensely debated (Merle, Azzouz, & Topin, 2022).

25. A limit to this assertion is the heterogeneity of an audience made up of signatories to the Principles for Responsible Investment, adopters of the Task Force on Climate-Related Disclosures, green bonds portfolio managers, impact-driven investors, or ESG analysts. Their awareness and maturity on sovereignty matters vary greatly.

26. See https://cpram.com/lux/en/individual/strategies/thematic-investing?filters%5b480%5d%5b%5d=86978.

27. Hook (2022) compared the weight of industrials within three indexes (MCSI USA, S&P 500, EAFE) between mainstream and ESG funds and concluded that industrials are slightly more present in ESG funds.

28. As per German Foreign Minister Annalena Baerbock, who stated: 'Europe is now heading for a united Europe from Lisbon to Luhansk, not to Vladivostok' (informal meeting of EU foreign ministers in Kyiv, October 2023).

29. Flexibility and exemptions already exist; see the recent decision from the European Commission (2023).

30. The French government in 2023 announced the creation of a Critical Metals Fund (CMF) to secure the supply of energy transition metals (e.g. lithium, nickel, cobalt) to French and European industrials, with an investment of €500 million operated by the Caisse des Dépôts (InfraVia, 2022).

31. The growing share of the fiscal space and of the EU's greenhouse gas emissions accounted for by the defence industry justifies the scrutiny, investment, and stewardship of the ESG community. According to estimates, militaries and their supporting industries may account for up to 5 per cent of global emissions (more than civilian aviation and shipping combined). Furthermore, defence industrials are often multi-activities with a strong footprint in the aircraft industry, for which decarbonisation is highly material (Parkinson & Cottrell, 2022).

32. The share of industrials out of total green, social, sustainability, and sustainability-linked bond amounts issued increased from 3 per cent in 2017 to 11 per cent in 2022. Trends for 2023 indicate a 17 per cent market share. This upward trend is encouraging, with industrials making their way in the market. The entry into force of the Delegated Act of the EU taxonomy on category 3 manufacturing activities and the development of sustainability-linked bonds are likely to sustain this trend.

33. Article 3 of the Climate Benchmarks Regulation sets a sectoral allocation constraint, requiring equity securities to have an exposure to high-impact sectors, broadly defined (sectors A–H and L of NACE), at least equivalent to aggregate exposure of investable universe.

34. Manufacturing activities in the EU taxonomy are for the most part eligible and principally regrouped under section 3: manufacturing of steel, iron, aluminium, batteries, car and building equipment, various organic and other chemicals, and plastic.

35. Of the 17 existing taxonomies as of July 2023, eight include hard-to-abate industries; these are included under either an industry or a manufacturing macro-sector. Of the 16 taxonomies under development, five have stated that they will also include such sectors (Canada: steel manufacturing; Australia: mining and manufacturing; Chile: mining and industry; Singapore: basic chemicals, cement, iron and steel, and plastics in the primary form; Hong Kong: aluminium and cement.

36. The enabling dimension of industries must be further incorporated into the EU's regulations and market guidance. It is regrettable that scope 4 was removed from the European Sustainability Reporting Standards of the CSRD (optional DR E1-14 – avoided greenhouse gas emissions from products and services). Avoided emissions play a key role (Mirova, 2022).

37. Overall, ESG or sustainability-sensitive investors barely factor in like-mindedness and adherence to rule of law, free speech, and liberal democracy, although human and labour rights safeguards are increasingly required in sustainable finance regulations.

38. The CRMA sets benchmarks along the strategic raw materials value chain and for the diversification of EU supplies: at least 10 per cent of the EU's annual consumption for extraction; at least 40 per cent of its annual consumption for processing; at least 15 per cent of its annual consumption for recycling; and no more than 65 per cent of its annual consumption from a single third country.

39. A target of at least 40 per cent of the EU's net-zero technologies annual deployment needs by 2030 met by domestic manufacturing.

REFERENCES

Bonneau, C., & Nakaa, M. (2020). 'Vulnérabilité des approvisionnements français et européens'. Rapport Trésor Eco, Ministère de l'Economie, des Finances et de la Relance, December. https://www.tresor.economie.gouv.fr/Articles/511478e4-5fb3-48a6-afbc-edc5186be04c/files/e1968df8-f94a-4718-bbeb-992db19864e6.

Canfin, P. (2023). 'La première loi européenne pour renforcer l'autonomie stratégique européenne sur les matières premières critiques'. LinkedIn post, September. https://www.linkedin.com/pulse/la-premi%25C3%25A8re-loi-europ%25C3%25A9enne-pour-renforcer-lautonomie-sur-canfin/?trackingId=.

De Souza, L., & Merle, C. (2023). 'The New Geography of Taxonomy', Natixis, 4 October. https://gsh.cib.natixis.com/our-center-of-expertise/articles/the-new-geography-of-taxonomies.

The Economist. (2023). 'Are Free Markets History? The Rise of Homeland Economics', 7 October.

European Commission. (2023). 'Commission Approves €659 million French State Aid Measure to Support Verkor in Researching and Developing Innovative Batteries for Electric Vehicles'. Press release, 30 October. https://ec.europa.eu/commission/presscorner/detail/en/IP_23_5324.

La Financière de l'Echiquier. (2023). 'La Financière de l'Echiquier Launches Echiquier Go Local, 1st Global Equity Strategy Focused on Resilience and Autonomy Needs of Strategic Sectors'. Press release, 4 April. https://www.lfde.com/en-ch/559-press-releases-en-en-ch/la-financiere-de-lechiquier-launches-echiquier-go-local-1st-global-equity-strategy-focused-on-resilience-and-autonomy-needs-of-strategic-sectors/.

García-Herrero, A., Grabbe, H., & Källenius, A. (2023). 'De-Risking and Decarbonising: A Green Tech Partnership to Reduce Reliance on China'. Bruegel Policy Brief, 26 October. https://www.bruegel.org/policy-brief/de-risking-and-decarbonising-green-tech-partnership-reduce-reliance-china.

Gollier, C. (2022). *Entre fin de mois et fin du monde: Economie de nos responsabilités envers l'humanité*. Paris: Collège de France.

Hook, M. (2022). 'An Evaluation of ESG Funds and Their Performance 2022'. Undergraduate Honours Thesis, University of Arkansas, May. https://scholarworks.uark.edu/finnuht/78/.

IEA (International Energy Agency). (n.d.). 'Russia's War on Ukraine'. https://www.iea.org/topics/russias-war-on-ukraine.

IEA (International Energy Agency). (2023). 'Europe's Energy Crisis: What Factors Drove the Record Fall in Natural Gas Demand in 2022?', 14 March. https://www.iea.org/commentaries/europe-s-energy-crisis-what-factors-drove-the-record-fall-in-natural-gas-demand-in-2022.

InfraVia. (2022). 'InfraVia Launches a Critical Metals Fund with the Backing of the State'. Press release, 11 May. https://infraviacapital.com/infravia-launches-a-critical-metals-fund/.

Merle, C., Azzouz, M., & Topin, Y. (2022). 'EU Social Taxonomy Proposal: Simpler and Meaningful but Half-Way Through'. Natixis, 24 March. https://gsh.cib.natixis.com/our-center-of-expertise/articles/eu-social-taxonomy-proposal-simpler-and-meaningful-but-half-way-through.

Merle, C., & Davasse, G. (2022). "The Clash between Sovereignty and Sustainability?'. Natixis, 24 March. https://gsh.cib.natixis.com/our-center-of-expertise/articles/the-clash-between-sovereignty-and-sustainabilityhere.

Mirova. (2022). 'Mirova & Robeco Lead Initiative to Develop Global Database of Avoided Emissions Factors and Associated Company-Level Avoided Emissions'. Press release, 16 May. https://www.mirova.com/sites/default/files/2023-05/PR_CEI-global-avoidance-factor-database_EN.pdf.

Parkinson, S., with Cottrell, L. (2022).'Estimating the Military's Global Greenhouse Gas Emissions'. Scientists for Global Responsibility and Conflict and Environment Observatory, November. https://ceobs.org/wp-content/uploads/2022/11/SGRCEOBS-Estimating_Global_MIlitary_GHG_Emissions_Nov22_rev.pdf.

Steinbach, A. (2022). 'The EU's Turn to "Strategic Autonomy": Leeway for Policy Action and Points of Conflict'. *European Journal of International Law*, 21 November. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4269304.

China's Green Industrial Policy and Its Implications for the EU–China Relationship

Du Ming

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

The chapter seeks to unpack China's green industrial policy and explore its implications for the China–EU relationship. It argues, first, that the role of state-level centralised green industrial policy is key to China's achievements in renewable energy. Second, China's approach to renewable energy features a pragmatic attitude of subordinating climate commitment to economic development prerogatives. Third, China's pro-growth mentality has shaped its international stance on climate change. The chapter further argues that China's domination in green technology has raised important policy questions for the EU. In response to China's green industrial policy, the EU is likely to enforce trade defensive measures more aggressively against China and launch its own green industrial policy as a critical part of its rebalancing effort.

ABOUT THE AUTHOR

Du Ming is a Professor at Durham Law School and the Co-Director of the Durham Global Policy Institute.

INTRODUCTION

The EU's quest to align its objective of a green transition to achieve climate neutrality and sustainability with the objective of open strategic autonomy and economic security, that is, the desire of the EU to shape its own economic destiny without being dependent on other countries, is complicated by several external and internal challenges (EC, 2023a: 1–2). Such challenges include the rise of geopolitics and the reconfiguration of globalisation, the unprecedented need for investment for the transition to a green economy, its high dependency on external energy suppliers, technological gaps, and a growing 'greenlash' against ambitious environmental agendas (Tocci, 2023), to name a few. This struggle illustrates a broader global conundrum: how to achieve sustainable progress in the context of international dependencies and domestic pressure.

China is facing a similar challenge of how to promote effective coordination and, if necessary, make a strategic trade-off between addressing climate change and poverty eradication, energy security, job creation, economic development, and other needs (State Council Information Office of the PRC, 2023: 4). The chapter aims to unpack how China seeks to combine the two sometimes competing objectives of ecological stewardship and economic development. It makes three key arguments. Firstly, central to China's impressive achievements in renewable energy is the role of state-level centralised industrial policy planning, which has effectively mobilised resources towards the green energy sector, sparking a cycle of green growth. Secondly, even though China is committed to sustainable development and carbon neutrality, China's approach to climate change is guided by a pragmatic attitude of subordinating climate commitment to economic development prerogatives. Indeed, even China's remarkable clean technology

campaign has more to do with its economic strategy than its climate commitments. Thirdly, China's current and future domination of clean technology has raised important questions for the EU. Going forward, the EU is likely to take a bifurcated approach. On the one hand, the EU will enforce trade remedy laws, which play a pivotal role in managing institutional diversity in the global trading system, more aggressively against China. On the other hand, the EU will launch its own industrial policy as a critical part of the rebalancing effort to boost domestic production. These trends are unlikely to change in the near future.

CHINA AS A VERITABLE GREEN POWER

As the world's second largest economy, China is the biggest emitter of greenhouse gases and accounts for half of the world's coal consumption. However, driven by the realisation that overreliance on coal is not sustainable for long-term development, China has embarked on a low-carbon path by transforming its energy composition (World Bank, 2022b). The energy transformation manifests in two ways simultaneously: one is to gradually reduce reliance on coal, and the other is to invest aggressively in renewables (World Economic Forum, 2023; Lin & Jia, 2020). China is now the largest domestic and outbound investor in renewable energy in the world. For example, China invested $546 billion in clean energy, including solar and wind energy, electric cars, and batteries, in 2022. This funding is nearly four times the amount invested by the United States, which totalled $141 billion (Hernandez, 2023). China is currently the world's largest and fastest-growing producer of renewable energy. China's lead in renewable energy has widened with an acceleration of solar and wind power capacity in recent years. According to Global Energy Monitor, China's solar capacity is now 228 gigawatts (GW), more than the rest of the world combined. China also leads the world in wind capacity at 310 GW. China is set to double its capacity and produce 1,200 GW of energy through wind and solar power by 2025, reaching its 2030 goal five years ahead of time (Mei et al., 2023). China is also the world's top supplier of renewable energy technologies. For instance, China dominates the solar panel supply chain from end to end, commanding more than 80 per cent of the world's solar panel manufacturing capacity at every stage. It can make 1,000 GW of solar modules each year, more than twice the global demand (IEA, 2022: 7–8). In the wind power sector, China captured 58 per cent of the global wind turbine manufacturing capacity in 2020 (Global Wind Energy Council, 2022: 58). China has also dominated the world's electric vehicle (EV) lithium-ion battery manufacturing market, with a 79 per cent market share in 2021 (Statista, 2023). The Chinese battery-maker CATL alone controlled a 37 per cent share of global EV battery sales in 2022 (Kim, 2023). Along the renewables supply chain, China dominated in the production of critical minerals in 2022, with a majority share of the global market for graphite (100 per cent), rare-earths (90 per cent), cobalt (74 per cent), lithium (65 per cent), copper (42 per cent), and nickel (17 per cent) (IEA, 2023: 50–59).

Based on official figures and commercial data, China's carbon dioxide (CO_2) emissions are set to fall in 2024 and could be facing structural decline due to record growth in the installation of new low-carbon energy sources (Myllyvirta, 2023). On its current trajectory, China could easily surpass its target of supplying a third of its power consumption through renewable sources by 2030 (Liu, 2022). This feat is a testament to the country's capacity to construct a mature and autonomous green energy supply chain, reinforcing its strategic independence in green energy.

What explains China's remarkable progress in growing its renewable energy sector? One key contributing factor is the Chinese government's commitment to transform its economic growth model towards green growth (State Council Information Office of the PRC, 2023). In the early stages of China's economic development, after its adoption of the reform and opening up policy in 1978, the country's rapid economic growth was accompanied by massive consumption of resources and enormous pressure on the environment and ecology. Urban water pollution, declining air quality, land degradation, and the increasing frequency of natural disasters highlighted the severe environmental costs of black economic growth. Since its accession to the World Trade Organization (WTO) in 2001, China has been the world's factory. The sharp increase in energy demand led to a further significant rise in China's share of global energy consumption and pollution emissions. These challenges forced China to shift towards a path of sustainable development and a low-carbon economy. At the Copenhagen Climate Change Conference in 2009, China emphasised its right to pursue economic development as a developing country and acknowledged its responsibility for environmental protection by setting specific emission reduction targets. Since then, sustainability has been embedded in China's economic growth planning (Dent, 2015). Although China's growth still resembles the traditional development model of simultaneous economic growth and greenhouse gas emissions that has been in place since

the Industrial Revolution in Britain in 1750, the rate of emission increase has been decreasing. More recently, Chinese President Xi Jinping pledged in 2020 to achieve peak CO_2 emissions before 2030 and carbon neutrality by 2060. A national strategy of actively responding to climate change was introduced in 2021 (State Council Information Office of the PRC, 2021). Xi's pledge provided a powerful political signal favouring renewable investments.

China is the world's largest EV market

The Chinese government's political commitment to renewable energy was accompanied by a full range of industrial policies (U.S.–China Economic and Security Commission, 2022: 263–264). Despite four decades of market-oriented reforms and 20 years of WTO membership, one key feature of China's economic model remains proactive: the formulation and execution of mandatory and ambitious industrial policies. Combining the power of an authoritarian state with the power of market capitalism, the Chinese government continues to exercise extensive direct and indirect control over the allocation of resources through instruments such as government ownership, government directives, and the control of key economic actors (Du, 2023). The energy transition, the upgrading of the electricity grid, and the development of the renewable energy manufacturing industry have been consistently identified as priority growth areas in key Chinese industrial policy documents, such as Made in China 2025, and in China's national economic planning, such as Five-Year Plans. These state-led industrial policies seek to make China dominant in global renewable energy manufacturing and set specific targets. In order to achieve this strategic goal, the Chinese government has deployed extensive government guidance, massive government subsidies, favourable taxation policies, preferential access to government procurement contracts, overseas mergers and acquisitions, and other types of financial and regulatory support (Li, 2021; Song et al., 2022).

Some of the industrial policies have incentivised both the supply of renewable energy and the demand for it. Take electric cars as an example. China began handing out financial subsidies to EV companies for producing buses, taxis, or cars for individual consumers in 2009. From 2009 to 2022, the Chinese government poured over 200 billion RMB ($29 billion) into relevant subsidies and tax breaks. The generous subsidies enabled EV companies to keep spending to improve their models and consumers to spend less to get an EV of their own. The government also helped domestic EV companies stay afloat in their early years by handing out procurement contracts for EVs to be used in China's vast public transportation system (Yang, 2023). But subsidies and tax breaks are not the whole picture; there were additional state policies that encouraged individuals to purchase EVs.

> In populous cities such as Beijing, car number plates have been rationed for more than a decade, and it can still take years or thousands of dollars to get one for a petrol car. But the process was basically waived for people who decided to purchase an EV.

In addition to offering incentives, the Chinese government also imposes regulations and applies pressure on both generating companies and provincial governments to meet renewable energy targets. For example, large generating companies have been required to meet specific renewables targets, such as a minimum 9 per cent of power generation from renewables by 2020. There is also an annual set of province-level minimum targets for percentage of total electricity consumption from non-hydro renewables. The central government audits the provincial performance in detail. National plans and campaigns to build large renewables bases, launched in coordination with provinces eager to obtain investment, are themselves a type of pressure on the state-owned generators to participate, which they inevitably do (Mei et al., 2023).

The Chinese government has also ensured financing not just for the plants themselves, but also for the supply chain and construction infrastructure necessary to build clean energy projects. By taking advantage of Chinese industrial policies, China's suppliers have relentlessly driven down costs, making renewables development economically competitive and sustainable while achieving dominance as the largest global supplier of renewable energy products.

This is not to suggest that an industry policy that features consistent state support is the only factor underpinning China's impressive growth in renewable energy. Indigenous innovation and entrepreneurship, cut-throat competition, highly integrated supply chains, huge domestic demand, and the economies of scale that only a country the size of China can offer all allowed China to develop its clean energy industry. For example, China's domestic demand for electricity, which rises 15 per cent a year, has created a large market for clean energy (Bradsher, 2022). The same is true for EVs. China is the world's largest EV market, with 6.8 million sold

in 2022. The point is only that China's success in renewable energy is due in no small measure to its industrial policy.

CHINA'S ECONOMIC DEVELOPMENT MENTALITY

Even though China is committed to sustainable development and carbon neutrality goals, it is essential to understand that China's approach to the green transition and climate change is guided by a pragmatic attitude of frequently subordinating its climate commitment to other policy objectives such as energy security, employment, and economic growth. China's strong economic development mentality not only explains some of China's paradoxical policy choices but also shapes the country's international stance on climate change.

Firstly, although China is making remarkable progress in its green transition, it is also the world's biggest coal consumer as well as the top emitter of climate-warming greenhouse gases. Indeed, despite China's rapid clean energy expansion, expansion of new coal power persists. For example, in the first quarter of 2023, provincial governments in China approved at least 20.45 GW of new coal projects, more than they did in all of 2021. Coal combustion is currently projected to increase at a 'reasonable speed' up to 2030 (Hawkins, 2023). The new flurry of investment in coal comes against a backdrop of concerns over energy security and economic stability due to high energy demand from domestic economic activity. Despite the negative impact of coal on China's decarbonisation agenda, coal has advantages of cost-effectiveness and supply stability to ensure energy security compared with clean energy (White, 2023). In other words, from Beijing's perspective, energy security outweighs the climate crisis.

From Beijing's perspective, energy security outweighs the climate crisis

Secondly, China's remarkable clean technology campaign was driven more by economic opportunism than by its climate commitments (Shuo, 2023). China believes that the green transition to reduced carbon intensity and climate adaptation worldwide will unlock new sources of economic growth, innovation, and job creation, with the added benefit of lowering China's reliance on imported fuels and enhancing its energy security (Yu, 2023). Importantly, as a global manufacturing hub, China is well positioned to turn climate action into an economic opportunity. In fact, China initially made forays into clean energy technology as a means for export (Chia, 2022). It was precisely the recognition of the immense economic opportunities in the green energy innovation that drove China to harness its competitive advantage in industrial policy consistency and lower-cost capital to lead the market in low-cardon industries. When conditions for outward investment and trade turned sour, China was able to adroitly set up a domestic market. The same pro-economic growth mentality that fuels coal development mentioned above has boosted China's clean energy sector.

The green transition has also been nicely customised to suit China's development needs. A case in point is the Solar Energy for Poverty Alleviation Program (SEPAP). The scheme enabled poor households to earn ~3,000 yuan per year from the program owing to the government's substantial subsidy. In 2021, the SEPAP increased by roughly 2,700 RMB for poor households, which is 90 per cent of the governmental goals (Jin & Ialnazov, 2022: 1). Various projections suggest that the transition to carbon neutrality in China will result in more job gains than losses (World Bank, 2022a: 30; IEA, 2021: 16).[1] China already has an estimated 54 million 'green jobs', including over four million jobs in renewable energy (World Bank, 2022b: 30).

Thirdly, climate policy-making in China has been nested in an institutional setting where the paramount objective is to achieve the industrial restructuring and upgrading considered vital for sustaining economic development. For a long time, the climate portfolio belonged to the National Development and Reform Commission (NDRC), which framed climate change as an economic issue rather than a purely environmental issue (Goron & Freeman, 2017: 209). Climate commitments will have to give way when they are perceived to be in irreconcilable conflict with other economic and security objectives.

China's strong pro-growth mentality has profoundly shaped its international stance on climate change. This has prevented China from making the much-needed political decision to start phasing out coal plants, which is necessary to meet the pledge to achieve carbon neutrality by 2060. For instance, China has refused to commit to any phase-out of fossil fuels (Wu, 2013). Two weeks before the COP28 climate conference, China and the United States agreed to back a global target to triple global renewable energy capacity by 2030. Still, China only agreed to 'accelerate the substitution for coal, oil and gas generation' but did not mention phasing out fossil fuels, a goal that China has described as 'unrealistic'. China argued that countries must refrain from employing 'empty slogans' that are

divorced from reality (Stanway, 2023). Possible de-growth due to environmental concerns is not an option for China.

IMPLICATIONS FOR THE CHINA–EU RELATIONSHIP

China's booming renewable energy sector presents both opportunities and challenges for the EU. On the one hand, China is playing a pivotal role in the global green transition. China's massive production is driving solar, wind components, and EV prices to all-time lows. The falling prices of clean energy will accelerate the EU's green energy transition at a reasonable cost. Moreover, there are significant collaborative opportunities between China and the EU in the green energy sector, especially in areas such as research and development, joint ventures, and the exchange of expertise in renewable energy technologies. China's rapid ascension as a green energy hub offers the EU a chance to become more deeply integrated with China's comprehensive green energy supply chains, potentially enhancing the EU's supply chain security and resilience. Investment flows from China into the European green energy sector could bring much-needed capital, driving forward the EU's sustainable energy initiatives.

On the other hand, China's dominance in green energy supply chains, from critical minerals to manufacturing assembly lines, also presents serious economic and security challenges for the EU. For one, China's swift scale-up of its new energy industry, facilitated by its centralised, 'top-down' approach through massive subsidies and credit incentives, has led to persistent overproduction and excess supply, saturating global markets and crippling international competitors (Wang et al., 2022). A case in point is the EU's recent anti-subsidy investigation into EV imports from China. For another, the EU's reliance on Chinese clean energy supply chains and the influx of affordable Chinese green energy products are perceived as a risk to the EU's 'strategic autonomy', of which energy security is a critical component (EC, 2023b). In response, the EU has implemented measures to reduce its dependence on Chinese supply chains and preserve its economic and energy sovereignty.

Going forward, the EU is likely to make active use of trade remedy laws to mitigate market distortions stemming from China's industrial policy. However, active use of trade remedy laws is a double-edged sword as it may delay the EU's green transition in view of China's significant advantages in the renewable energy sector. Relatedly, the limited ability of WTO trade remedy laws to deal with China's industrial policy challenges is well known (Bown & Hillman, 2019). We are likely to see the EU become a 'norm entrepreneur' and apply trade remedy laws more innovatively against China. Moreover, in cases where traditional trade tools fail to address the impact of Chinese industrial policy, there is an emerging trend of other countries launching their own industrial policy as a critical part of the rebalancing effort. The EU is no exception. The industrial policy arms race will, however, make it even harder to decry China's industrial subsidies. Therefore, the future of China–EU relations hinges on finding a delicate balance between cooperation and competition, guided by a shared commitment to a greener world.

CONCLUSION

China has embedded the construction of its international identity in promoting and leading global climate governance (Yang, 2022). This chapter unpacks China's green industrial policy and analyses its implications for the China–EU relationship. It finds, first, that the role of state-level centralised green industrial policy is central to China's achievements in renewable energy. Second, China's approach to renewable energy features a pragmatic attitude of subordinating climate commitment to economic development prerogatives. Third, China's pro-growth mentality has shaped its international stance on climate change.

China's domination in green technology has raised important issues, such as the country's unfair trade practices (Silver, 2021), its human rights violations (Reinsch & Arrieta-Kenna, 2021), and the EU's economic sovereignty, with profound implications for geopolitical competition (Kaya Partners, 2023). Going forward, the EU is likely to enforce trade defensive measures more aggressively against China to protect against unfair competition. Furthermore, the EU is likely to launch its own green industrial policy as a critical part of the rebalancing effort to boost domestic production.

In the EU's quest for a green industrial revolution, such orchestrated balancing efforts will be crucial for unfolding a sustainable and strategically autonomous future.

NOTE

1. But see Sun et al. (2022: 727), who find that unemployment caused by the green transition from coal power cannot be entirely absorbed by the employment demand induced by renewable energy.

REFERENCES

Bown, C.P., & Hillman, J.A. (2019). 'WTO'ing a Resolution to the China Subsidy Problem'. *Journal of International Economic Law*, 22(557), 567–572.

Bradsher, K. (2022). 'China Is Leading Global Race to Make Clean Energy'. *New York Times*, 30 January.
Chia, T. (2022). 'How China Is Winning the Race for Clean Energy Technology'. Harvard Fairbank Centre for Chinese Studies, 26 October.
Dent, C.M. (2015). 'China's Renewable Energy Development Policy: Industry and Business Perspectives'. *Asia Pacific Business Review*, 21(1), 26–43, DOI: 10.1080/13602381.2014.939892.
Du, M. (2023). 'Unpacking the Black Box of China's State Capitalism'. *German Law Journal*, 24(1), 125–150.
EC (European Commission). (2023a). *2023 Strategic Foresight Report: Sustainability and People's Wellbeing at the Heart of Europe's Open Strategic Autonomy.*
EC (European Commission). (2023b). 'European Economic Security Strategy'. June.
IEA (International Energy Agency). (2021). 'An Energy Sector Roadmap to Carbon Neutrality in China'.
IEA (International Energy Agency). (2022). *Special Report on Solar PV Global Supply Chains*. July. https://iea.blob.core.windows.net/assets/d2ee601d-6b1a-4cd2-a0e8-db02dc64332c/SpecialReportonSolarPVGlobalSupplyChains.pdf.
IEA (International Energy Agency). (2023). 'Critical Minerals Market Review 2023'. July. https://www.iea.org/reports/critical-minerals-market-review-2023/implications.
Global Wind Energy Council. (2022). *Annual Wind Report 2022*.
Goron, C., & Freeman, D. (2017). 'Industry Policy and Climate Change Strategy'. In Mario Telo (ed.), *Deepening the EU–China Partnership*, pp. 204–219. London: Routledge.
Hawkins, A. (2023). 'China Ramps Up Coal Power Despite Carbon Neutral Pledges'. *The Guardian,* 24 April.
Hernandez, B. (2023). 'China Poured $546 Billion into Clean Energy Last Year'. Yahoo Finance, 23 February.
Jin, Z., and Ialnazov, D.S. (2022). 'Sustainability Assessment of Individual-Level Solar Energy Poverty Alleviation Program: A Case on Jinzhai County, China'. *Front. Sustain*. 3:1072141. doi: 10.3389/frsus.2022.1072141.
Kaya Partners. (2023). 'Race to the Top on Clean Energy: The US and EU Response to China's Dominance'. Inevitable Policy Response, January. https://www.unpri.org/download?ac=17824.
Kim, H. (2023). 'China's CATL Extends Lead as World's Top EV Battery Maker'. Bloomberg, 4 January. https://www.bloomberg.com/news/articles/2023-01-04/china-s-catl-extends-lead-as-world-s-top-ev-battery-maker?leadSource=uverify%20wall.
Li, Y.N. (2021). 'Renewable Power Generation Subsidies in China: An Economic Feasibility Analysis and Policy Recommendations'. June. https://www.pp.u-tokyo.ac.jp/wp-content/uploads/2016/02/51208258YunwenLi.pdf.
Lin, B., & Jia, Z. (2020). 'Economic, Energy and Environmental Impact of Coal-to-Electricity Policy in China: A Dynamic Recursive CGE Study'. *Science of the Total Environment*, 698 (1 January), 134241.
Liu, Z. (2022). 'Challenges and Opportunities for Carbon Neutrality in China'. *Nature Reviews Earth and Environment*, 3, 141–155.
Mei, D. et al. (2023). 'A Race to the Top China 2023: China's Quest for Energy Security Drives Wind and Solar Development'. Global Energy Monitor Report, June. https://globalenergymonitor.org/report/a-race-to-the-top-china-2023-chinas-quest-for-energy-security-drives-wind-and-solar-development/.
Myllyvirta, L. (2023). 'China's Emissions Set to Fall in 2024 after Record Growth in Clean Energy'. *Carbon Brief*, 13 November.
Reinsch, W.A., & Arrieta-Kenna, S. (2021). 'A Dark Spot for the Solar Energy Industry: Forced Labor in Xinjiang'. Center for Strategic and International Studies (CSIS), 19 April.
Shuo, L. (2023). 'Is China Really Leading the Clean Energy Revolution? Not Exactly'. *The Guardian*, 6 July.
Silver, K. (2021). 'China's Trade Practices Come under Fire'. BBC News, 21 October.
Song, D., Jia, B., & Jiao, H. (2022). 'Review of Renewable Energy Subsidy System in China'. *Energies*, 15, 7429. https://doi.org/10.3390/en15197429.
Stanway, D. (2023). 'China Warns against "Empty Slogans" at COP28 Climate Talks'. Reuters, 27 October.
State Council Information Office of the People's Republic of China. (2021). 'Responding to Climate Change: China's Policies and Actions', October. http://www.ncsc.org.cn/yjcg/cbw/202111/P020211117406748792288.pdf.
State Council Information Office of the PRC. (2023). 'China's Green Development in the New Era'. http://www.scio.gov.cn/zfbps/ndhf/49551/202303/t20230320_707669.html.
Statista. (2023). 'EV Lithium-ion Battery Production Capacity Shares Worldwide 2021–25, by Country', 24 October.
Sun, D. et al. (2022). 'Economic and Employment Effects of China's Power Transition Based on Input-Output and Scenario Simulations'. *Advances in Climate Change Research*, 13(5), 721–728.
Tocci, N. (2023). 'After Two Years of Real Progress on Climate, A European "Greenlash" Is Brewing'. *The Guardian*, 12 July.
U.S.–China Economic and Security Commission. (2022). '2022 Annual Report to Congress'. https://www.uscc.gov/annual-report/2022-annual-report-congress.
Wang, X. et al. (2022). 'Industrial Policy and the Rise of China's Strategic Emerging Industries'. https://www.aeaweb.org/conference/2023/program/paper/SQSRZ3Bk.
White, E. (2023). 'China Ramps up Coal Power While Pushing for Renewables', *Financial Times*, 15 June.
World Bank. (2022a). 'China: Country Climate and Development Report'. https://www.worldbank.org/en/country/china/publication/china-country-climate-and-development-report.
World Bank. (2022b). 'China's Transition to a Low-Carbon Economy and Climate Resilience Needs Shifts in Resources and Technologies', 12 October.
World Economic Forum. (2023). 'Fostering Effective Energy Transition 2023', 28 June.
Wu, F. (2013). 'China's Pragmatic Tactic in International Climate Change Negotiations: Reserving Principles with Compromise'. *Asian Survey,* 53(4), 778–800.
Yang, J. (2022). 'Understanding China's Changing Engagement in Global Climate Governance: A Struggle for Identity.' *Asia Europe Journal* 20, 357–376. https://doi.org/10.1007/s10308-021-00643-1.
Yang, Z. (2023). 'How Did China Come to Dominate the World of Electric Cars?' *MIT Technology Review,* 21 February.
Yu, C. (2023). 'How China Cornered the Green Market'. *The Spectator,* 2 December.

Industry Dependency Risk Assessment and Realistic Policies

Alexander Sandkamp

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

This chapter evaluates the evolving trade dynamics between the EU and China against increasing geopolitical tensions worldwide. It scrutinises the EU's strategic pivot from decoupling to de-risking in response to multifaceted challenges, including Taiwan, the Ukrainian conflict, and human rights issues. The focus centres on attenuating the EU's dependency on China, particularly in essential sectors and procurement of critical raw materials. It recommends incentivising diversification by reducing trade costs with other potential source countries, highlighting that increased trade with other countries would both reduce dependence on China and strengthen the EU's geopolitical position in the world.

ABOUT THE AUTHOR

Alexander Sandkamp is assistant professor of economics, in particular quantitative trade at the University of Kiel and member of the Research Center Trade Policy at the Kiel Institute. His research focuses on the application of gravity models to evaluate trade policy.

INTRODUCTION

China is one of Europe's largest trading partners and, with a share of 15.4 per cent of EU-27 trade in 2022, is second only to the United States with 15.6 per cent (Eurostat, 2023). Against the backdrop of increasing geopolitical tensions between the EU and China over Taiwan's independence, Russia's war in Ukraine, and concerns regarding human rights and supply shortages following China's zero-COVID policy, this interdependence seems to be turning into a liability. Consequently, the European Commission is looking for ways to reduce interlinkages with China (EC, 2022).

In its endeavour to reduce dependence on China, the European Commission (together with the governments of Member States such as Germany) has recently shifted its approach from 'decoupling' towards 'de-risking'. While the former may be interpreted as a policy-induced reduction in trade with China, the latter emphasises the need for diversification and self-reliance in strategic sectors (EC, 2023). Nevertheless, even the more drastic decoupling is not completely off the table – think of a military conflict between China and Taiwan which could cause an escalating spiral of sanctions and counter-sanctions between China and the political West.

This chapter aims to contribute to a better understanding of the potential costs of such a decoupling by shedding more light on current trade relations between the EU and China. It shows that while China is the largest source country of European imports, its overall economic significance is much smaller once EU domestic production is taken into account. Nevertheless, China dominates the supply of several products in the electronics industry and of critical raw materials needed for a successful energy transition. This dependence makes the EU vulnerable not only to political blackmail but also to

production disruptions in China more generally. The EU should respond by providing EU companies with incentives to diversify their procurement away from China without cutting trade ties completely.

CHINA HAS BECOME INCREASINGLY IMPORTANT FOR THE EU

Figure 1 shows the development of EU-27 exports to China over the past ten years both in absolute terms and as a share of total EU exports. Bilateral exports have increased continuously during this period, even though growth slowed during the height of the COVID-19 pandemic in 2020. In 2022, EU exports to China peaked at €230 billion, which constitutes almost 9 per cent of the total. This made the country the third largest destination of EU exports, behind only the United States (19.8 per cent) and the United Kingdom (12.8 per cent).

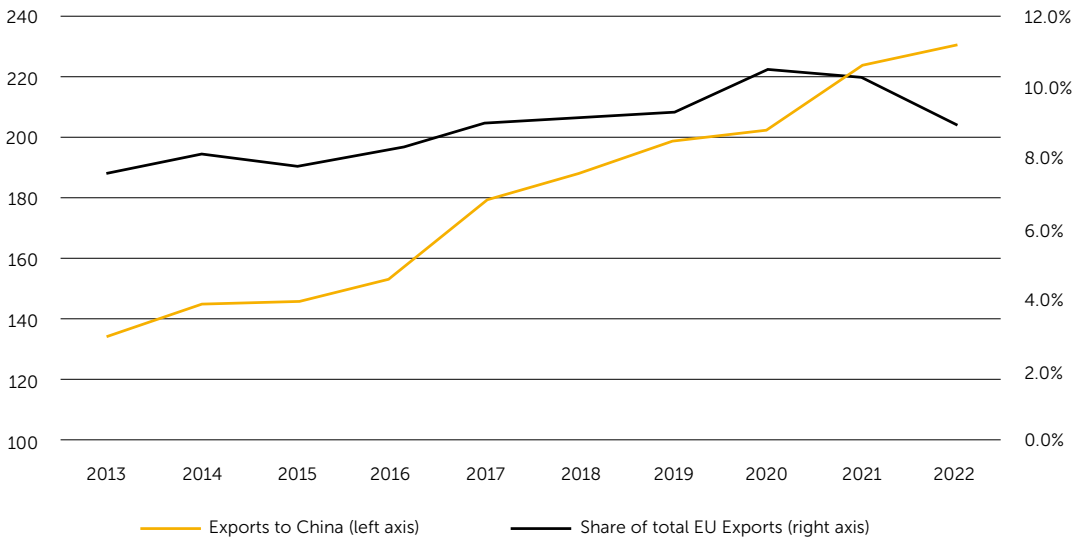
While China's share in total EU exports increased more or less continuously until its peak of 10.5 per cent in 2020, it has been declining since 2021. Even though exports to China continued to grow, they did so at a lower rate than exports to the rest of the world. It is not yet clear whether this constitutes a trend reversal. Instead, it could reflect a temporary weakness in Chinese expenditure, driven by the country's zero-COVID strategy and a troubled construction sector. Nevertheless, this development should be welcomed as it demonstrates that aggregate dependence on China (measured as the country's share in total EU exports) can be reduced without trading less with China and simply by increasing trade activities with other regions.

A similar development can be seen for EU imports from China, as Figure 2 indicates. Imports from China continuously increased over the past ten years, reaching almost €627 billion (20.9 per cent of total imports) in 2022. This makes China the largest source country of EU imports, ahead of the United States (12 per cent) and the United Kingdom (7.2 per cent). However, with imports from the rest of the world increasing at a faster pace since 2021, this share has fallen below its peak of 22.4 per cent in 2020. While the EU is hence far from independent from China, the trend is currently moving towards de-risking.

TRADE STATISTICS DO NOT PAINT THE WHOLE PICTURE

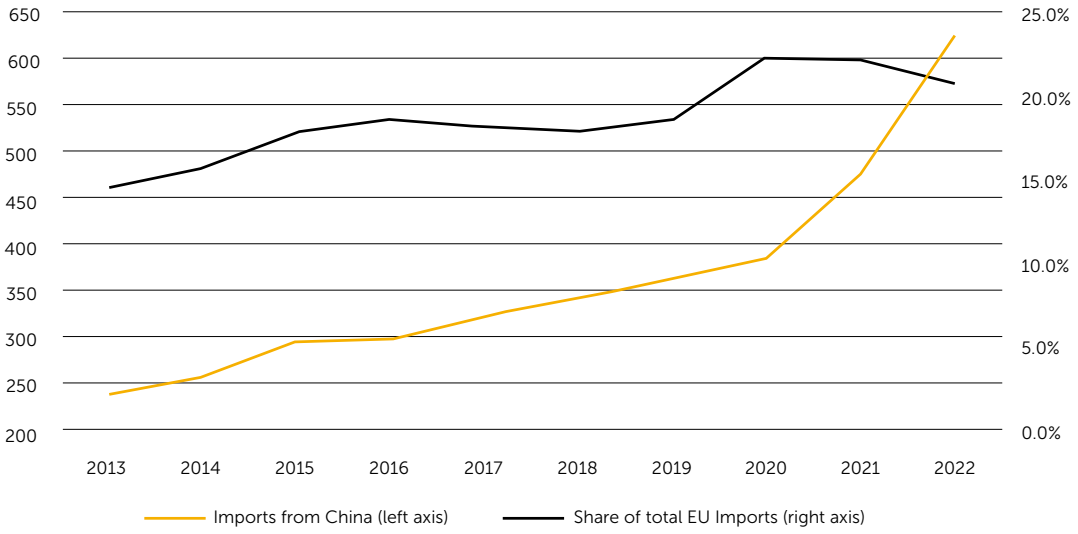
Such trade statistics, while important, only paint an incomplete picture. They omit the importance of intra-EU trade as well as Member States' own productive capacity. Take Germany – the EU's largest economy – as an example. In 2022, 6.8 per cent of German exports went to China (Destatis, 2023). One reason why this figure is smaller than the EU's 9 per cent is that it takes into account Germany's exports to other EU Member States, which accounted for 54.6 per cent of the country's exports that year. Similarly, China's share in German imports in 2022 was 12.8 per cent (recall the EU value was 20.9 per cent), whereas the EU accounted for 49.4 per cent of Germany's total imports. The EU therefore remains its own most important trading partner.

FIGURE 1: **EU 27 exports to China, in bn. €**



Source: Data from Eurostat (2023)

FIGURE 2: **EU 27 imports from China, in bn. €**



Source: Data from Eurostat (2023)

Looking at trade statistics alone is, however, not sufficient to determine China's economic importance for EU Member States because they disregard domestic production. Looking once again at Germany, Sandkamp et al. (2023) show that China's direct share in German consumption was 1.4 per cent in 2018 (most recent available data). China's share of intermediate products used for production in Germany (which is different from consumption because it also includes goods deemed for export) is only 0.6 per cent.

In addition to such direct dependencies, indirect linkages also play a role. Indirect linkages to China exist if a product imported from a third country is produced in that country using inputs from China. Indirect linkages are highly relevant when considering production disruptions in China – such as zero-COVID – that potentially affect all importers of Chinese products. Similarly, trade disputes between China and the United States, for instance, would disrupt Chinese exports to the United States, in turn affecting US exports to the EU that are produced with the help of Chinese inputs. Including such indirect linkages increases the share of Chinese value added in German consumption (production) to 2.7 per cent (1.5 per cent). These indirect dependencies mean that even if a country completely eliminated its imports from China, its dependence would not yet be reduced to zero.

IN THE LONG RUN, DECOUPLING FROM CHINA IS POSSIBLE BUT COSTLY

Given these interdependencies, Felbermayr, Mahlkow, and Sandkamp (2023) model the impact of a decoupling between the EU and China. This is done by simulating a doubling in trade barriers, which would reduce trade between the two economies by around 97 per cent (Table 1). In this scenario, some production would shift back to the EU, while most of the remaining imports would be diverted away from China and towards other source countries. China would do the same, resulting in the almost complete elimination of bilateral trade.

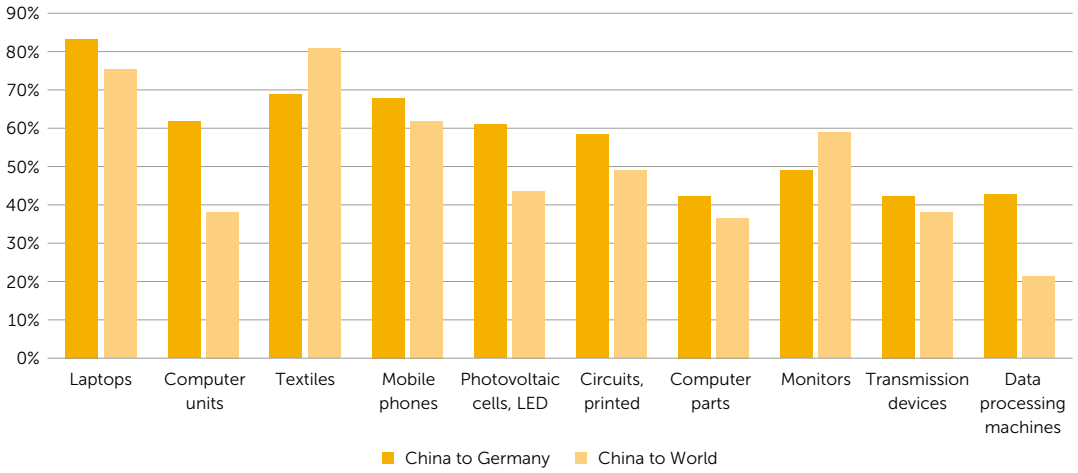
Such decoupling would permanently reduce real income in the EU by 0.8 per cent (Table 1). Measured in terms of GDP in 2022, this means that the EU would forgo €126 billion of value added every year compared with a scenario in which trade relations remained unaltered. For China, the permanent loss would be 0.9 per cent of GDP. These losses may

TABLE 1: **Long-run change in exports and real income following decoupling**

	Change in bilateral exports		Change in real income	
	EU	**China**	**EU**	**China**
Decoupling EU – China	**–97.7%**	**–96.2%**	**–0.8%**	**–0.9%**

Note: EU-27.
Source: Felbermayr, Mahlkow, & Sandkamp (2023)

FIGURE 3: **Chinese share in German and world imports for selected HS6 product groups 2021, in per cent**



Note: Only product groups with a Chinese export value to Germany of at least €1 billion are shown.
Source: Sandkamp et al. (2023)

seem bearable at first glance, but the findings should be taken with a pinch of salt. The simulated results are long-term effects which are only realised once trade has been fully redirected and production has relocated. This is a process that can be expected to take more than ten years. In the short to medium term, the impacts may be expected to be more severe, as the following section explains.

EXTREME DEPENDENCE FOR INDIVIDUAL PRODUCTS MAKES DECOUPLING DIFFICULT IN THE SHORT TERM

In the short term, decoupling from China would be costlier because China is the dominant supplier of a large variety of products imported into the EU, which cannot be easily substituted. Looking once again at Germany, Figure 3 shows that Europe's largest economy imports 83 per cent of its laptops from China. At the same time, China is responsible for 75 per cent of global exports. The first number suggests that there is at least some room for diversification. However, if the entire EU and possibly other Western economies such as the United States decoupled from China at the same time – for example because of an escalating conflict between China and Taiwan – this would inevitably result in a scramble for the remaining suppliers, at least in the short term. This is true for many product groups such as mobile phones (68 per cent import share) and photovoltaic cells and LEDs (61 per cent).

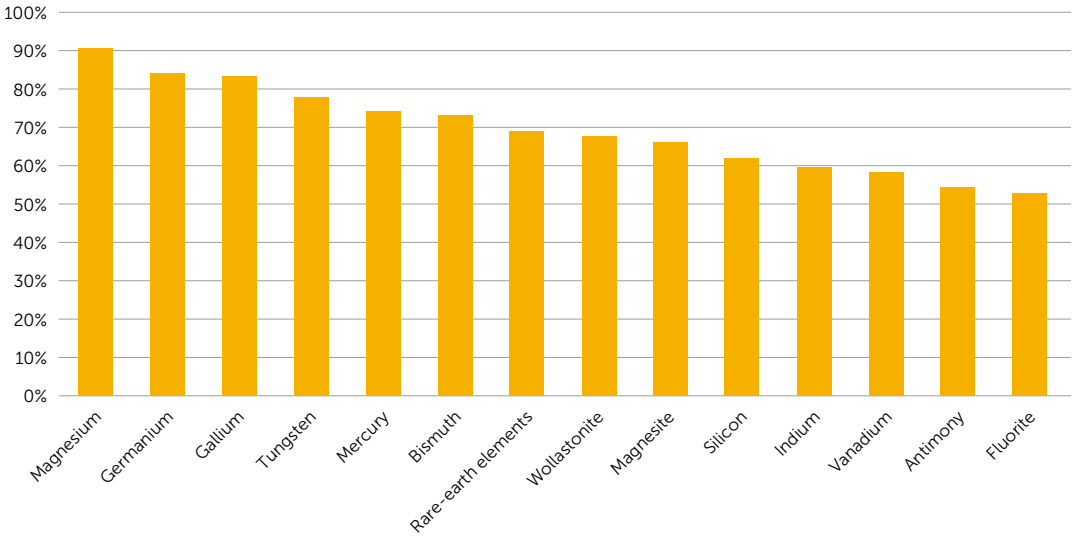
Out of the 6,791 (HS8 digit) products Germany imported from China and Taiwan in 2021, 127 saw a Chinese share of more than 80 per cent (Sandkamp et al., 2023). These include the rare-earth elements scandium and yttrium (used for example for the production of LEDs and electrodes), antimony (used for semiconductors), and germanium (semiconductors). The 80 per cent threshold is of course arbitrary, yet it illustrates the important role China plays in the supply of many products to European economies.

ENERGY TRANSITION WOULD BE DELAYED WITHOUT CHINA

China dominates not only German imports of critical raw materials such as germanium (which China announced would become subject to export restrictions in 2023), but also global production. When measuring dependence on China, the latter seems to be the relevant metric, as many raw materials are only imported from China indirectly, that is, through the import of products which use these resources as inputs. To better understand China's role in critical raw materials, Figure 4 illustrates the country's share in global production of selected raw materials. China is by far the largest producer of magnesium (used for fuel cells), germanium, gallium, indium, and silicon (used for photovoltaic cells), as well as rare-earth elements (used for wind power stations and electric motors).

As the above examples illustrate, many of these raw materials are critical for the European energy transition. The good news is that most of them can in principle be sourced from other countries. The bad news is that setting up production facilities usually takes years. A sudden disruption in imports from China can thus be expected to slow down

FIGURE 4: **China's share in global production of raw materials**



Note: Only includes raw materials for which China's share in global production is larger than 50 per cent.
Source: Sandkamp et al. (2023), data from German Mineral Resources Agency (2021)

the energy transition significantly. The current dependence on China in this area thus constitutes a trade-off between sustainability and industrial sovereignty.

DE-RISKING CAN BE ACHIEVED BY FACILITATING TRADE WITH OTHER COUNTRIES

With the Critical Raw Materials Act and the European Chips Act, the European Commission is reiterating its intention to move towards EU industrial sovereignty. Successful de-risking requires a coherent strategy that avoids the temptation to pour subsidies into highly visible flagship projects. Simply shifting manufacturing (back) to Europe will not eliminate dependence on China. After all, a semiconductor manufacturing or battery plant does not lead to strategic autonomy as long as the silicon and lithium needed to run them continue to be imported exclusively from China. In addition, limited (human) resources mean that the EU cannot – and should not – strive to produce everything itself.

While a short-term fix may be close to impossible, there are a lot of steps the EU could and should take in order to regain independence from Chinese suppliers in the medium to long term. By emphasising de-risking over decoupling, the European Commission is already moving in the right direction. Forcing European companies to stop importing from China would put the EU in exactly the position it is trying to avoid – being cut off from critical resources which are essential for the success of the energy transition. In addition, such a ban might induce European companies to simply shift production outside the EU.

Instead, the EU should strive to diversify its procurement of those resources, as well as other products currently dominated by China. This can be achieved by increasing the attractiveness of other potential source countries relative to China. If it becomes cheaper to import products from other countries, these will almost automatically gain market share. One way to reduce the cost of importing from other countries is through free trade agreements. They can lower both tariffs and non-tariff barriers, both of which artificially increase trade costs. Potential partners in this regard include Australia (e.g. for magnesium and rare-earths), with which the EU is currently negotiating a trade agreement, and Malaysia (rare-earths), with which negotiations are currently frozen (Godart et al., 2023).

In addition to directly increasing the competitiveness of suppliers in partner countries, free trade agreements also increase planning certainty. If potential miners know that they can export raw materials cheaply and reliably to the EU, they will have stronger incentives to invest in new mines. Brazil is an example of a country which has large reserves of rare-earths but currently is not counted among the largest exporters (Godart et al., 2023). Securing access to critical raw materials is thus an

important reason to finally reach a deal on the EU–Mercosur trade agreement.

Investment protection agreements and sector-specific investment credit guarantees might also help boost foreign direct investment of European companies in the extraction and processing of critical raw materials in partner countries. From a development perspective, the EU should find ways to encourage the processing of raw materials in the country in which they are extracted. Building downstream industries could help resource-rich economies move away from merely exporting raw materials and towards exporting higher-value products.

DO NOT TRADE LESS WITH CHINA, BUT TRADE MORE WITH OTHERS

Although China's share in EU trade has fallen over the past two years, the country remains both the largest source of EU imports and one of the most important destinations for European exports. Decoupling would thus entail significant costs for both economies. This is particularly true in the short term, as many products and raw materials that are predominantly sourced from China would be hard to substitute.

Both the European Commission and individual Member States should thus do everything they can to incentivise diversification by reducing trade costs with other potential source countries. Redirecting trade flows this way will take time and may not be sufficient to fully achieve the envisaged de-risking. Other measures such as increased recycling and material efficiency may be at least as important as they simultaneously address industrial sovereignty and sustainability. Incentivising the shift of some production back to Europe may also be part of the solution, although it should be achieved not through subsidies but by raising productivity, for example by reducing the bureaucratic burden which binds urgently needed human capital.

Continuing to increase trade with other countries would not only reduce dependence on China but also strengthen the EU's geopolitical position in the world and further increase prosperity both at home and among its partners. By trading more with other countries and not less with China, the EU could master the current challenge by staying true to its conviction of a free and open society.

REFERENCES

Destatis. (2023). Genesis-Online Database, 'International Trade'. https://www-genesis.destatis.de/genesis/online.

EC (European Commission). (2022). 'Opening Remarks by President von der Leyen at the Joint Press Conference with President Michel Following the Meeting of the European Council of 21 October 2022'. https://ec.europa.eu/commission/presscorner/detail/en/statement_22_6322.

EC (European Commission). (2023). 'Speech by President von der Leyen on EU–China Relations to the Mercator Institute for China Studies and the European Policy Centre'. https://ec.europa.eu/commission/presscorner/detail/en/speech_23_2063.

Eurostat. (2023). 'International Trade in Goods'. https://ec.europa.eu/eurostat/web/international-trade-in-goods/data/database.

Felbermayr, G., Mahlkow, H., & Sandkamp, A. (2023). 'Cutting Through the Value Chain: The Long-Run Effects of Decoupling the East from the West'. *Empirica*, 50, 75–108.

German Mineral Resources Agency. (2021). DERA-Rohstoffliste 2021 – DERA Rohstoffinformationen 49.

Godart, O., Abel, P., Bode, E., Heimann, T., Herrmann, C., Kamin, K., Peterson, S., & Sandkamp, A. (2023). 'Resilienz der Langfriststrategie Deutschlands zum Klimaschutz'. *Studie Im Auftrag Der Wissenschaftsplattform Klimaschutz*, January.

Sandkamp, A., Stamer, V., Wendorff, F., & Gans, S. (2023). 'Leere Regale Made in China: Wenn China beim Handel mauert'. Kiel Policy Brief No. 164.

Strategic Autonomy and Green Supply Interdependence: The Role of Foreign Direct Investment

Peter Cowhey

https://doi.org/10.53121/ELFS7 • ISSN (print) 2791-3880 • ISSN (online) 2791-3899

ABSTRACT

Creating a sustainable economy demands massive investments, improved productivity, and innovation at a scale and scope requiring significant interdependence among the EU, United States, and China. Yet growing worries over national security and unfair commercial practices threaten sustained interdependence. The chapter proposes prioritising an EU–US agreement on a framework for monitoring and regulating Chinese foreign direct investment (FDI) in green supplies and technologies. FDI as a policy tool has a long history of permitting significant interdependence even with substantial trade barriers and complex regulations. A coordinated Atlantic framework could mitigate risk, address major political pressures, and still sustain many benefits of interdependence.

ABOUT THE AUTHOR

Peter Cowhey is the Qualcomm Professor of Communications and Technology Policy Emeritus at the University of California, San Diego. He was a trade and regulatory policy official in the Obama and Clinton administrations.

THE GREEN SUPPLY CHALLENGE IN AN ERA OF GEOECONOMIC RIVALRY

The depressing facts about limiting the damage from climate change are all too familiar. Global efforts to abate the build-up of greenhouse gases will require trillions of dollars of investment, the massive and rapid scaling up of green-friendly products and services, and major innovations (including carbon sequestration). Improved efficiency, cost reduction, and rapid 'learning by doing' will be critical to the effort. Even then, the world will likely exceed the goal of limiting temperature increases to 1.5 degrees centigrade and will be lucky to achieve less than 2.0 degrees centigrade. And the costs of ameliorating the damage will be sobering (Victor & Ramanathan, 2023).

An honest assessment of the challenges' magnitude highlights the need to use the strengths of global markets to complement the essential work of governments. As Hanson and Slaughter (2023) note, global market liberalisation for digital technology, in the form of the World Trade Organization's (WTO) Information Technology Agreements, greatly accelerated the benefits of digital products and shows how trade could advance success in a green economic transformation.

Unfortunately, the shift to a sustainable world economy entails larger questions about strategies of economic growth and equity within and across countries. It also raises pressing geostrategic questions about national security. The three largest nodes of global investment, trade, and technology innovation – the EU, the United States, and China – have a growing economic, technological, and strategic rivalry. Some of the complaints about China echo the tensions over Japan's market conduct in the 1980s, such as trade protectionism, intellectual property theft, and export subsidies. However, the anchor of a military security alliance with Japan

tempered those economic disputes' outcomes. Today, growing US and EU worries about security issues with China further complicate choices about how much interdependence with China for green supplies and technologies is acceptable.

Fears of regional economic losses to other world leaders in growing green markets propel expanding industrial policy programmes and trade restrictions. Efforts to accelerate a green transition through subsidy measures, such as those found in America's Inflation Reduction Act, create frictions even between the tightly interlinked interests of the United States and Europe and pose much worse ones with China. For example, the US subsidy programme for electric vehicles (EVs) specifically impacts Chinese-made EVs, restricting their availability in the country, and the United States will likely use other trade tools to limit Chinese EV access to its market if necessary (Cutler, 2023). So the US needs another tool. Similarly, France and Germany are urging taking a strong stance to shield the EU EV industry from subsidised Chinese imports. And the European Commission has endorsed domestic production targets for green technology such as solar panels and heat pumps (*The Economist*, 2023a, 2023b). Further escalating the tensions with China is the growing digital dimension of the green infrastructure, such as more efficient management of electric grids, which introduces new cybersecurity worries.

The European Commission has endorsed domestic production targets for green technology

FOCUSING ON FOREIGN DIRECT INVESTMENT TO SUSTAIN INTERDEPENDENCE

Geoeconomic tensions about security and commercial leadership create conflicts over how to reconcile the traditional rules of global trade and investment with the green transition (Bowen & Clausing, 2023; Attinasi, Boeckelmann, & Meunier, 2023; Hanson & Slaughter, 2023). Even with the deeply interlinked interests of the EU and the United States, the US–EU effort to establish a broad framework on technology and green trade issues had very disappointing results in autumn 2023. Instead of prioritising another attempt at a general trade framework, this chapter suggests focusing on a more tractable political solution that can also yield major gains for sustainability. This approach would craft a transatlantic framework for guiding Chinese foreign investment in the green supply base of the Atlantic region. The framework will restrict some investments but also build confidence to encourage others.

A framework for Chinese investment can safeguard some degree of green supply interdependence in a manner consistent with the goal of 'strategic autonomy' advocated by the European Liberal Forum. As Pogorel, Nestoras, and Cappelletti (2022) explain, strategic autonomy rejects protectionism, but it advocates providing the EU (and, presumably, its counterparts) with the tools of industrial policy for European undertakings to accelerate a technologically progressive path to sustainable development that meets broader security, social, and economic goals. None of this can happen without massive investment and the best technical know-how. Refocusing EU–US coordination of policy on the rules governing Chinese foreign direct investment (FDI) in green supplies would facilitate the necessary monies and know-how while addressing competition and security issues.

Economically, FDI has major benefits for scaling investment, market efficiency, strategic autonomy, and innovation. FDI increases local production for security purposes and infuses skills and technology that come because they are competitive assets for the investors. For example, the knowledge and skills spillover to local suppliers, plus expansion of local input chains, accelerated China's growth (Meyer, 2023). While theft of intellectual property was also a cause of spillover in China, the know-how transfer from FDI is observed generally. Indeed, EU governments are offering large subsidies to foreign producers of semiconductors to build plants in their countries to garner these benefits. Moreover, accelerating overall global expansion of production and demand (by lower costs and better products) builds 'external economies of scale' for the industry as a whole (Bown & Clausing, 2023).

The benefits for the EU's green supply base from Chinese FDI could be substantial. It would be far more productive for the EU if Chinese EVs were manufactured in the EU. The EU has good capabilities in heat pumps (better than those of the United States) but the production expertise that would come from Chinese investment would be a valuable addition to local know-how and worker skills. Chinese producers have made advances in battery chemistry that could spread to the EU through manufacturing investments. Or, imagine investments and engineering expertise for green methanol and hydrogen fuel supplies for cargo ships serving the route from Rotterdam to Houston.[1]

THE POLITICAL ECONOMY OF A FOCUS ON FDI

Atlantic coordination on investment is not simple but it has two advantages. Firstly, we have considerable experience with liberalising markets through FDI while selectively restricting the flows of traded goods. Secondly, it does not require perfect agreement to establish good enough parallelism in transatlantic policy to evolve workable guidelines for Chinese FDI.

Our experience with FDI as a route for maintaining and expanding global flows of goods, services, and know-how is extensive. While commonly forgotten, during the expansion of free trade after 1945 the automotive industry was subject to a thicket of protectionist barriers to shield local producers. Automobiles were too large as a manufacturing bellwether and too politically sensitive for jobs to liberalise on a wholesale basis. Indeed, the United States tacitly accepted the trade barriers as long as access to markets remained open for US car companies through FDI and joint ventures with local firms (Cowhey & Aronson, 1993). This was not an optimally efficient market, but the formula grew liberalisation even during political storms. For example, when the US–Japan disputes over trade escalated, a key compromise was the massive rise in FDI by Japanese automakers in the United States to create more jobs, value added, and production skills.

The political benefits of the FDI approach begin with immediate economic softening of displacement effects from opening local industry to foreign competition and then extend by creating a new set of vested interests in sustained investment schemes. In the medium term these forces often opposed further market rationalisation, but fundamental shifts in technology and world markets eventually induced a reconsideration of interests. FDI was not perfect, but it beat the alternatives.

More recently, China's rise as a manufacturing powerhouse and then a production innovator was partly the result of China's policies that conditioned market access on the establishment of robust production facilities to serve domestic and export markets. This formula of conditioning market access on investment rightly had many economic critics in the OECD. Yet it also illustrated the power of FDI for driving efficiency and innovation in national markets. Politically, FDI somewhat eases the controversies over the corollary import of goods and services to support the investment. It also addresses the question of maintaining employment in politically sensitive industries. And it reduces the upset of foreign competitors about restrictions hampering the purest forms of free trade.

FIRST PRINCIPLES FOR DESIGNING THE POLICY

Experienced policy officials know that it is hard to get the technical and legal specifics of any major initiative right. Political compromises will also be necessary. This brief discussion of first principles simply lays out starting considerations for the policy design.

Any effort to coordinate green supply investment frameworks across the Atlantic consistent with strategic autonomy starts with a labyrinthian status quo. FDI guidelines exist explicitly (as in the US Committee on Foreign Investments' rules) or implicitly (as in trade rules of origin that condition the degree of foreign inputs into a local production plant). The hazy thicket of national security conditions plays a growing role.

Crafting a comprehensive framework from day one is an ill-advised venture. The right policy solution often is not obvious when balancing competing goals. The initial focus should only be on investment in green goods, services, and technologies. The goal should be to establish a unifying approach that creates more transparency in policy logic (both within the United States and the EU and to possible Chinese investors) and chooses some particular green supply products and services where the conditions for favourable treatment of investments would be clarified. This approach would build some confidence about an FDI-centric approach to green supply interdependence. Here is one approach.

1. The *mission goal* is the advancement of strategic autonomy, not protectionism, towards a secure sustainable economy. FDI can achieve many of the benefits of markets while recognising the complexities of strategic autonomy in a politically and diplomatically volatile environment. FDI is not a panacea, but it bolsters investment, increases security of supply by local production, creates jobs, and incentivises efficiency and innovation.

2. The *policy tool* is an agreed upon regulatory framework for FDI with as much convergence as possible between the United States and the EU. The priority is to sort out an approach to investments (with their supporting flows of goods, services, and technology) from China for green supplies in the EU and the United States. The framework is not a trade agreement, but it can (and should) borrow best practices from decades of trade policy. For example, trade rules allow legitimate regulatory oversight (including on market entry) for public interest reasons. But they insist on non-discrimination in the treatment of all firms once an FDI presence is green-lighted.[2]

3. Use an *analogous template borrowed from the WTO subsidies code* to set out a model guide for FDI in green supplies from non-market economies such as China. The subsidies code established the concept of a Green (safe/acceptable)–Yellow (permissible if properly conditioned)–Red (presumption that unacceptably violates guidelines) Box scheme. The boxes classify the acceptability of various subsidy measures. Here the boxes would code a more complex set of tests:

4. The *conditions determining the boxes* would be:

a. *eligibility for domestic subsidies* if the foreign firms received significant competition-distorting subsidies (broadly defined), a factor looming large in EVs;[3]
b. *conformity to rules of origin* specified for particular types of green supply investments (e.g. batteries or solar panels) and any rules requiring joint venture partners; and
c. *Security risks* – for example, it would greatly simplify matters if the criteria simply declared that Chinese digital control systems for the grid, such as SCADA systems, were unacceptable.

5. Develop a *pilot list of green supplies that fit each box*. These are regulatory decisions so they may be changed after a transparent decision process. However, it is important to begin setting expectations about how the framework could be applied to a vast array of goods, services, and technologies that will never be formally categorised unless necessary.

6. Develop *complementary EU–US cost–benefit analyses of economic and security risks from green supply technologies*. Total agreement will be impossible, but substantial common ground is possible. For example, analysts can remind us that the security risks of certain types of green tech are minimal and in some cases, such as carbon capture and sequestration, not feasible without enormous investment sums (Karplus, Morgan, & Victor, 2021; Davidson et al., 2022).

The world has a staggering task to retool towards a sustainable economy. Even assuming much stronger government actions, the productivity and innovation capacity of green supply markets will be crucial. Unlocking massive new investment funding will be crucial. Yet the complexities of economic rivalries, the concern over social equity, and attention to geostrategic risks threaten to hamper global markets significantly. The Biden administration has urged the EU to explore new forms of coordination outside traditional trade frameworks, but the Commission is cautious about abandoning the international trade regime. This proposal narrows the scope of policy coordination to a political economic formula that has co-existed with free trade for decades. At the same time, it can accelerate progress by using global markets to achieve a more sustainable economy.

NOTES

1. My thanks to Professors David Victor and Michael Davidson for examples in this paragraph.
2. The framework should be targeted to define policies for non-market economy investors. Tensions between the United States and the EU on specific industrial policy measures could be tracked to ad hoc problem solving for now.
3. This should be treated as a competition issue. The use of countervailing duties against Chinese EVs would remain an issue of trade policy, not the investment framework.

REFERENCES

Attinasi, M.-G., Boeckelmann, L., & Meunier, B. (2023). 'The Economic Costs of Supply Chain Decoupling'. European Central Bank Working Paper Series 2839.

Bown, C.P., & Clausing, K.A. (2023). 'How Trade Cooperation by the United States, the European Union, and China Can Fight Climate Change'. Peterson Institute for International Economics Working Paper 23-8, October.

Cowhey, P.F., & Aronson, J. (1993). *Managing the World Economy: The Consequences of Corporate Alliances*. Council on Foreign Relations.

Cutler, W. (2023). 'US Has the Trade Tools Needed to Combat China's EVs, but It Must Use Them'. *Financial Times*, 2 October.

Davidson, M.R., Karplus, V.J., Lewis, J.I., Nahm, J., & Wang, A. (2022). 'Risks of Decoupling from China on Low-Carbon Technologies'. *Science* 377, 1266–1269.

The Economist. (2023a). 'The Battle for Europe's Soul', 25 March.

The Economist. (2023b). 'Inspecting under the Bonnet', 16 September.

Hanson, G.H., & Slaughter, M.J. (2023). 'How Commerce Can Save the Climate: The Case for a Green Free Trade Agreement'. Foreign Affairs, 102, 119. https://www.foreignaffairs.com/world/how-commerce-can-save-the-climate-green-free-trade-agreement.

Karplus, V.J., Morgan, M.G., & Victor, D.G. (2021). 'Finding Safe Zones for Science'. *Issues in Science and Technology*, 38(1), 76–81.

Meyer, R. (2023). 'America Can't Build a Green Economy without China'. *New York Times*, 19 July.

Pogorel, G., Nestoras, A., & Cappelletti, F. (2022). 'Editorial: Digital Strategic Autonomy, A Crucial Imperative for Europe'. European Liberal Forum. https://liberalforum.eu/wp-content/uploads/2022/06/Decoding-EU-Digital-Strategic-Autonomy_ELF-Study_Techno-Politics_vol.1-2.pdf.

Victor, D.G., & Ramanathan, V. (2023). 'Don't Focus Only on Emissions'. *Los Angeles Times*, 15 October.

As the European Union advances towards sustainability, it confronts complex issues in industrial policy, international trade, and relations. Avoiding idealistic visions for a Green Utopia, it is time for a pragmatic, technology-focused strategy to effectively meet its climate targets and promote a sustainable, prosperous future.

This study explores key aspects of industrial sustainability, economic growth, and policy execution to provide a detailed analysis of the EU's progress towards sustainability.

In an era marked by rapid environmental and geopolitical shifts, this book provides essential insights into shaping a resilient, sustainable future for the EU.

liberalforum.eu

ISBN 978-2-39067-066-7