Balancing Ambition and Reality

A Sober Examination of Challenges in the EU's Green Transition

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Executive Summary

This study evaluates the European Union's Green Deal that seeks to achieve climate neutrality by 2050 and the green transition more broadly, focusing on the balance between ambition and practicality. The study analyses strategic approaches to the net-zero transition, including the Green Deal Industrial Plan and the associated legislative measures such as the Net-Zero Industry Act and the Critical Raw Materials Act, critically assessing the effectiveness of these and other initiatives. The broader EU's approach to green transition is contrasted with the USA's Inflation Reduction Act. Additionally, the study highlights the economic and regional disparities in implementing the Green Deal, emphasising the need for targeted support for economically vulnerable regions. It also evaluates the EU's funding strategies, identifying an annual investment gap and proposing more innovative solutions to address this gap. The study underscores the need for a balanced approach that aligns ambitious climate goals with economic realities, ensuring a just and inclusive transition for all EU member states.

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1 Introduction

The European Union's ambitious green transition aims to achieve climate neutrality by 2050, spearheaded by a comprehensive suite of policies under the European Green Deal. This study rigorously examines the delicate balance between aspiration and feasibility within the EU's green transition framework. The analysis delves into the strategic plans, legislative measures, and economic realities underpinning the transition, scrutinising their effectiveness and implementation.

Section 2 provides an overview of the European Green Deal, detailing its comprehensive policy initiatives aimed at achieving climate neutrality by 2050. It discusses the integration of various sectors, the ambitious emissions reduction targets, and the early impacts of these policies on energy prices and market dynamics.

Section 3 examines public opinion on climate change and the Green Deal, highlighting a significant gap between general support for climate action and the willingness to undertake specific measures. It explores regional variations in attitudes and the challenges of gaining broad public support for stringent climate policies.

Section 4 explores the European Commission's "Green Deal Industrial Plan for the Net-Zero Age," unveiled in early 2023, which aims to position the EU as a global leader in the clean energy economy. It outlines a comprehensive strategy centred on simplified regulations, increased funding access, addressing labour shortages, and enhancing trade to support the green transition. Key legislative measures include the Net-Zero Industry Act and the Critical Raw Materials Act. This section critically evaluates these plans' financial strategies and industry reception, comparing them to the USA's Inflation Reduction Act and discussing China's dominance in green technologies. Additionally, it examines the industry's calls for a more ambitious European Industrial Deal, as articulated in the Antwerp Declaration, and the strategic insights from the Letta Report. The Letta Report emphasises innovation, digital transformation, regulatory simplification, and securing supply chains, highlighting the need to balance competitiveness with the EU's green ambitions.

Section 5, a case study, focuses on the EU's 2035 ban on internal combustion engine vehicles, examining its legislative journey, the challenges in scaling up electric vehicle production, and the political pushback against the ban. To illustrate more thoroughly the challenges, the section also addresses the impact of rising car prices, the feasibility of electric and hydrogen fuel cell vehicles, and the adequacy of the EU's infrastructure plans to support these transitions.

Section 6 explores the economic disparities and regional vulnerabilities exacerbated by the Green Deal. It highlights the financial and infrastructural challenges faced by smaller and less affluent Member States, the inadequacy of the Just Transition Fund, and the need for a more equitable and supportive approach to ensure a balanced green transition across the EU.

Section 7 discusses the significant investment gaps the EU faces in achieving its green and digital transition goals. It evaluates proposed solutions for increased public

spending, mobilising private investment, and creating dedicated funds for strategic projects. It also suggests policy enhancements to ensure efficient and equitable investment across Member States.

2 The European Green Agenda: Ambitions vs. Reality

2.1 Overview of the European Green Deal

The European Green Deal is a set of policy initiatives designed to guide the EU towards a green transition, aiming for climate neutrality by 2050. The deal emphasises a holistic, cross-sectoral approach, requiring all relevant policy areas to contribute to the climate goal. The all-encompassing package includes legislation and initiatives on climate, environment, energy, transport, industry, agriculture, and sustainable finance, highlighting their strong interconnections.

A hallmark of European Commission President Ursula von der Leyen's tenure, the European Green Deal was launched by the European Commission in December 2019. As von der Leyen noted, "We are determined to tackle climate change and turn it into an opportunity for the European Union."[1] The European Council, where the Deal was presented, noted for its part that "The transition to climate neutrality will bring significant opportunities, such as potential for economic growth, for new business models and markets, for new jobs and technological development."[2] In a plenary debate on the same week with the European Parliament, von der Leyen emphasised the Green Deal's potential as an engine for Europe's growth: "The European Green Deal is our new growth strategy. And this time, it is a growth strategy that is not consuming – but it is a new growth strategy that is more giving back than it takes away."[3]

The Green Deal package, encompassing various legislative measures, is more commonly identified by the underlying legislation and initiatives such as the EU Circular Economy Action Plan, the Farm to Fork strategy, and the Nature Restoration Law, among others. To finance the Green Deal, the Sustainable Europe Investment Plan aims to attract at least EUR 1 trillion in public and private investment over the next decade. Meanwhile the Just Transition Mechanism aims to help regions most affected by the transition, ensuring a fair and inclusive move towards a greener economy.[4]

As part of the 2050 climate neutrality push, the Commission also proposed the emissions reduction of 55% by 2030, as compared to 1990. To reach the 2030 target, the European Commission proposed the Fit for 55 package in 2021. This package aims to reduce emissions from various sectors and includes measures such as revising the EU's Emissions Trading Scheme, promoting sustainable aviation fuels, and setting new targets for renewable energy and energy efficiency. Comprising in total of 13 legislative measures designed to assist all sectors of the EU economy and facilitate the Green Deal's implementation, the Fit for 55 package was adopted rather swiftly.[5] This includes the contentious legislation to ban internal combustion engine (ICE) vehicles by 2035, a prominent and widely recognised component of the EU's green initiatives.

2.2 Initial Impacts of Early Climate Policies

The implementation of the Green Deal has barely begun, yet the rapid transition's impacts are already evident, particularly in the energy sector. The spike in gas and electricity prices across Europe started in the latter half of 2011, well before Russia's invasion of Ukraine. At a European Parliament environment committee meeting, Fatih Birol, chief of the International Energy Agency, dispelled the notion that climate policies were driving these price increases. "It is inaccurate and unfair to explain these high energy prices as a result of clean energy transition policies. This is wrong,"[6] he stated. In fact, the opposite was true.

Europe's immediate problem was the surge in natural gas prices as the global economy rebounded from the COVID-19 pandemic. However, the deeper issue lies in the increased dependence on gas due to the variability of wind and solar power. As countries expanded their renewable energy capacity, the intermittent nature of these sources necessitated greater reliance on gas to fill the gaps when renewable output was low. Gas prices, being highly volatile, exacerbated the situation. A summer of low wind and overcast skies left Europe scrambling, paying record prices for liquefied natural gas to meet its energy needs.[7]

The fact that higher renewable penetration drives up energy prices has been established. Renewable Portfolio Standards (RPS) in the US, which mandate that a certain percentage of electricity must come from renewable sources like wind and solar, have significantly impacted energy prices. A comprehensive study found that electricity prices increased by 11% seven years after RPS implementation, mainly due to indirect grid integration costs such as transmission and the intermittency of renewable sources.[8] This dynamic is equally applicable to the EU, where renewable energy mandates and integration challenges similarly affect energy prices and grid stability.

One could argue that at the very least green energy is always better for CO2. Yet France has demonstrated that it is possible to decouple economic growth from CO2 emissions. In fact,[9] France has significantly reduced its per capita CO2 emissions from fossil fuels and industry over the years. The use of nuclear energy, with France deriving over 65% of its electricity from nuclear sources, has been a critical factor in this success, as it provides a stable and low-carbon energy source that has supported the country's economic development without a corresponding increase in greenhouse gas emissions.

In contrast, Germany's decision to abandon nuclear energy has led to a more challenging situation regarding CO2 emissions. To bridge the gap, the country has had to rely more on fossil fuels and less reliable renewable energy sources, which have not been able to fully offset the emissions reduction that nuclear energy could provide. As a result, Germany continues to struggle with higher CO2 emissions compared to France, despite significant investments in renewable energy infrastructure.[10]

Investor Withdrawal from ESG Funds and Its Impact on the EU's Green Agenda

The debate on green policies is often portrayed as settled, with only backward politicians questioning them. However, the reality is more nuanced, with legitimate concerns about the pace and effectiveness of green initiatives being raised by various stakeholders. Global investors are increasingly withdrawing funds from ESG (Environmental, Social, and Governance) equity funds due to various setbacks, including underperformance, scandals, and political attacks. In 2024, there was a net outflow of $40 billion from these funds, marking the first year of negative flows. US investors alone pulled out $4.4 billion in April, while European ESG funds saw $1.9 billion in outflows during the same month. Criticisms include the poor returns of sectors such as clean energy, which have not kept pace with fossil fuel companies, and high-profile scandals like the DWS greenwashing probe. Political opposition has further strained the sector, with US Republicans labelling ESG investing as partisan activism.[11] This withdrawal trend has significant implications for the EU's green agenda, which relies on sustainable investment to achieve its ambitious climate goals.

This trend is not isolated. Influential figures in the financial domain like Warren Buffett are opposing ESG initiatives. At Berkshire Hathaway's annual meeting In 2021, Buffett and his board opposed shareholder resolutions calling for climate change and diversity reports.[12] This resistance to ESG underscores a broader scepticism among traditional investment leaders about the practicality and financial implications of such initiatives. Political shifts in the EU affect investor confidence, with notable declines in renewable energy stocks like Vestas, Nordex, and Orsted, reflecting concerns over a potential slowdown in the green energy transition.[13]

Political Shifts and Challenges to the EU's Climate Policies

The recent rightward shift in the European Parliament following the election signals a significant challenge to the EU's overly ambitious climate policies. With gains for euro-realist parties,[14] more pragmatic of the EU's costly and impractical Green Deal, further push for allegedly green policies will likely become considerably more difficult. Although most existing policies will likely remain due to their legal entrenchment, the momentum for new, stringent climate measures will face substantial resistance. As Krzysztof Bolesta, Poland's secretary of state for climate, told Reuters, while backsliding is unlikely, "All new [climate] policies will be harder to pass."[15]

Similarly, while the EU's core climate change targets are expected to stay, their feasibility is increasingly questioned. Existing policies, such as renewable energy targets and a strengthened carbon pricing regime, are proving burdensome for member states. EU emissions reductions and the rapid expansion of wind and solar energy are commendable, but not without significant economic costs.

The increasing electoral strength of conservative and euro-realist parties reflects growing discontent among European citizens with the perceived economic burden and regulatory overreach of the EU's climate agenda. This sentiment is particularly pronounced in regions heavily dependent on fossil fuels or with significant industrial sectors, where the transition to green energy is seen as a threat to jobs and economic

stability. The Nature Restoration Law is a prime example. Ahead of the June European parliamentary elections, EU lawmakers weakened the law in response to protests and widespread public dissatisfaction. Critics argued that the NRL imposed unrealistic burdens on farmers and landowners, potentially harming local economies. Originally intended to rehabilitate 20% of European nature by 2030, the targets for restoring agricultural land and peatland were significantly reduced.[16]

Moreover, the rising energy costs, exacerbated by geopolitical tensions and the ongoing war in Ukraine, have amplified public scepticism towards the EU's climate policies. High energy prices have placed a strain on households and businesses, leading to calls for a more balanced approach that considers economic realities alongside environmental goals. The insistence on rapid decarbonisation without adequate consideration for energy security and affordability has alienated key constituencies and fuelled political backlash. Nor are recent developments helping, such as the second emissions trading system (ETS2) and its impact on diesel fuel that is forecast to cost motorists an extra 50 cents a litre from 2031.[17]

The pushback against the Green Deal and going green more broadly, popularly labelled as "greenlash", also includes concerns about the EU's competitive position globally. Critics argue that stringent climate policies could undermine Europe's industrial base and lead to a loss of economic competitiveness, particularly in relation to countries with less ambitious climate targets. This perspective has found resonance among many voters who fear that climate policies could lead to deindustrialisation and economic decline.[18]

Going Forward

In response to these challenges, the EU may need to recalibrate its approach to climate policy. This could involve more flexible frameworks that allow for greater national discretion and a more gradual transition. Increased investment in technological innovation, including carbon capture and storage, as well as support for nuclear energy, might also be necessary to achieve climate goals without compromising economic stability.

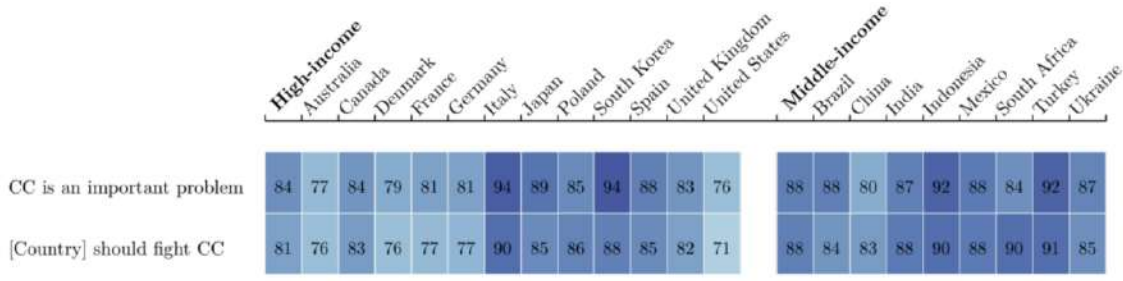
Furthermore, the EU will likely need to enhance its support mechanisms for regions and sectors most affected by the green transition. This includes targeted funding, retraining programs, and measures to ensure a just transition for workers in traditional industries. Building a broad-based coalition for climate action will require addressing legitimate economic and social concerns, not just imposing top-down mandates.

Czech MEP Alexandr Vondra, from the European Conservatives and Reformists (ECR) group, stated that future climate policies must combine practical measures with ambitious targets. He compared previous Green Deal policymaking to driving a car using only the accelerator, calling for a more balanced approach that also uses the steering wheel and brakes.[19]

3 Public Perception and Willingness to Act on Climate Change

The European Commission's frequently referenced statistics on climate action suggest that the Green Deal is justified. According to the Commission, over three-quarters of Europeans (78%) acknowledge that environmental issues directly impact their daily lives and health. Additionally, approximately four out of five respondents (84%) agree that EU environmental legislation is essential for protecting the environment in their country.[20] However, these figures reflect general support for the concept of action rather than specific implementation measures or concrete proposals. Nor do they reflect people's willingness to take action. When people are asked about specific aspects of the Green Deal or action on climate more broadly, a different set of opinions emerges.

Agreement on the Importance of Climate Change and the Need for National Action



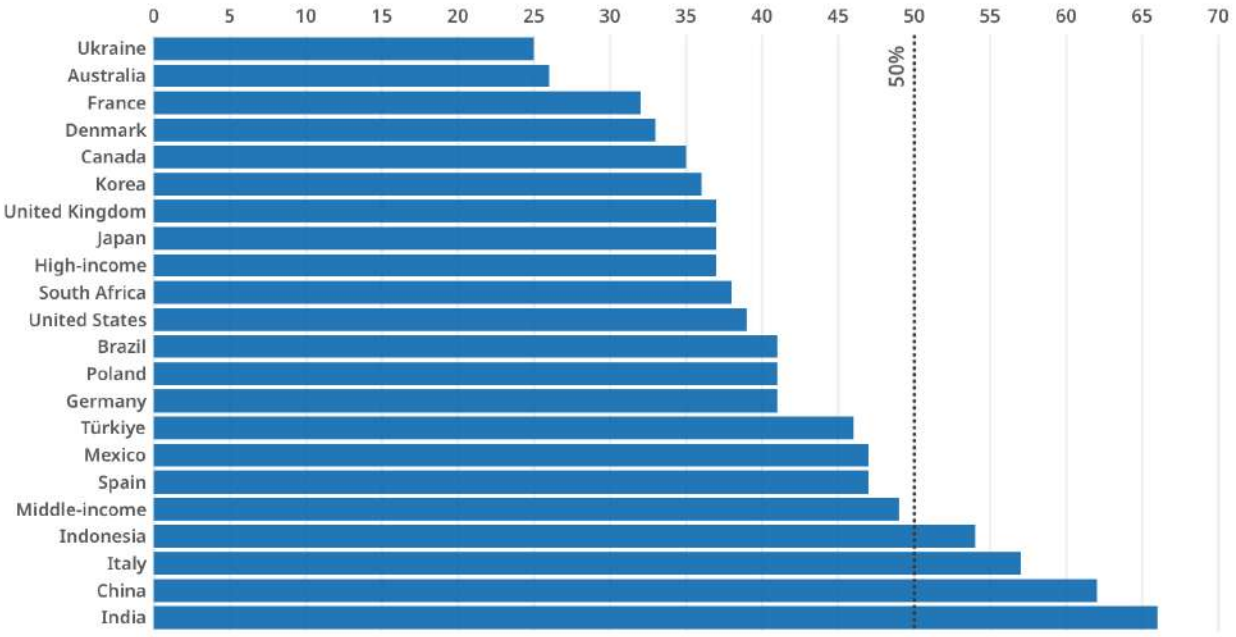
Dechezleprêtre et al., 2022

The OECD's survey across 20 major carbon-emitting countries reveals a significant divergence between acknowledging climate change as an important issue and the willingness to take concrete actions to combat it. Willingness to adopt specific behavioural changes—such as reducing driving, heating, or beef consumption—remains notably limited.

For example, support for limiting driving exceeds 50 percent only in countries with inherently lower driving rates, such as Indonesia and India, with Italy being an exception. In countries that are often considered more environmentally conscious, such as Denmark and France, support for reducing driving stands at only 33 percent and 32 percent, respectively. Similarly, the willingness to limit heating or cooling at home is low, with support around one-third in Denmark (33 percent), Germany (36 percent), and France (39 percent).

The survey underscores that support for climate policies is closely linked to the availability of low-carbon alternatives and the perceived fairness of these policies. Public resistance tends to be higher in areas more dependent on carbon-intensive

Willingness to Adopt Climate Friendly Behaviour by Limiting Driving

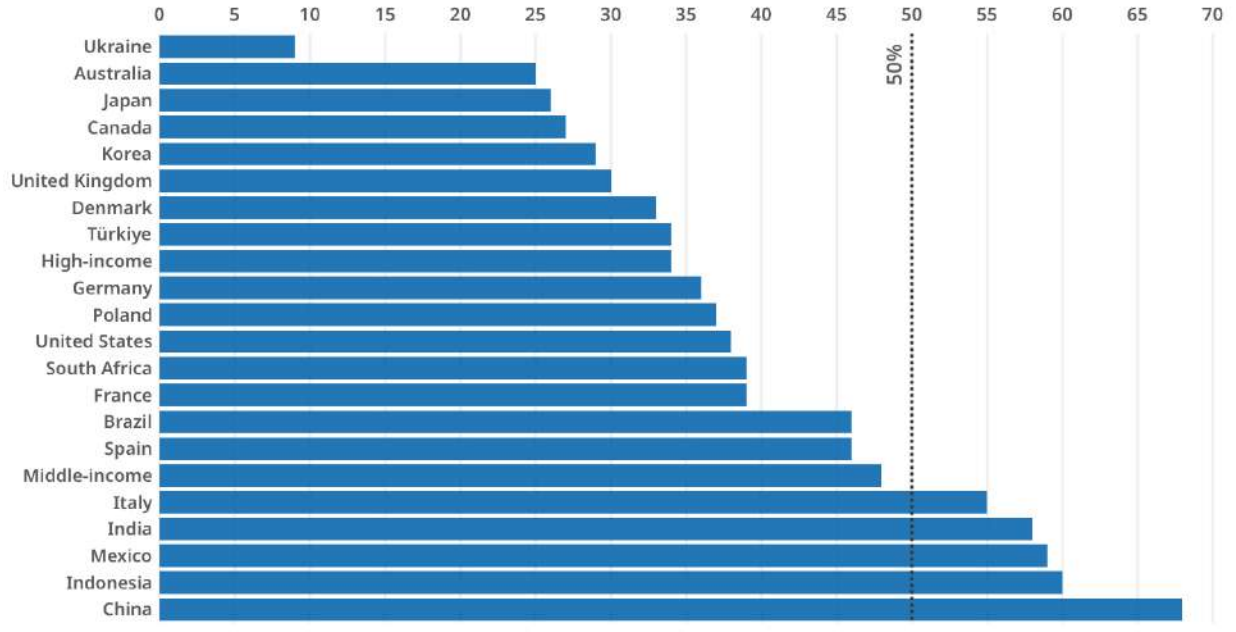


Note: The Figure shows the share of respondents who answered "a lot" or "a great deal" to the question "To what extent would you be willing to adopt the following behaviours?". The question uses a 5-point scale: "Not at all", "A little", "Moderately", "A lot", "A great deal".
Source: Fighting Climate Change: International Attitudes toward Climate Policies

OECD

Dechezleprêtre et al., 2022

Willingness to Adopt Climate Friendly Behaviour by Limiting Heating or Cooling Home



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Source: Fighting Climate Change: International Attitudes toward Climate Policies

OECD

Dechezleprêtre et al., 2022

activities, whereas support increases when policies include measures to protect vulnerable groups or when the benefits are clearly communicated. More importantly, the survey highlights a substantial gap between nominal support for climate initiatives and the actual willingness to undertake concrete actions, indicating that stated concerns do not always translate into practical commitments.[21]

3.1 Public Resistance to Personal Sacrifices

A study conducted by the Nordic Council of Ministers and Nordregio highlights the complexity and diverse perspectives surrounding climate policies in the Nordic region, challenging the more unified picture often presented by the European Commission. While a significant portion of Nordic citizens express concern about climate change and support for climate initiatives, the survey reveals notable disparities in perceptions based on socio-demographic factors.

For instance, 71% of respondents consider climate change a serious problem, yet only half support increased financial investments in climate prevention if it means higher taxes. Additionally, while urban residents are more likely to back climate measures, those in rural areas and towns show more scepticism, particularly concerning the economic impact of these policies. Furthermore, only 52% believe current climate policies have a neutral economic effect on their households, with 28% reporting negative impacts, highlighting that the perceived benefits and burdens of climate actions are unevenly distributed across different social groups and regions.[22]

A report querying the attitudes in Poland commissioned by New Direction, a conservative think tank, finds that the European Green Deal has generated considerable concern among the Polish population. The survey conducted revealed that 44% of Poles worry about the negative impact of the Green Deal on the Polish economy, with men being more likely to foresee adverse effects compared to women. Additionally, 35% of respondents remain undecided, reflecting a significant level of uncertainty about the policy's outcomes.

In terms of regional impact, the majority of Poles believe that the Green Deal will affect Central and Eastern European (CEE) industries more severely than those in Western Europe. Specifically, 42% of Poles are concerned about negative impacts on the CEE region compared to 25% who worry about the West. The agriculture sector is identified as the most vulnerable, with 73% of respondents indicating it will suffer significant losses. Furthermore, while there is substantial support for the Green Deal within the European Parliament and among EU commissioners, many Poles are sceptical about its overall benefits. Support for farmers' protests against the Green Deal is robust, with over 60% of respondents expressing their backing, highlighting widespread apprehension about the policy's economic implications.[23]

The European Commission's own surveys find a dissonance between acknowledgment and willingness to act. A 2023 Eurobarometer survey reveals a gap between concern and action willingness regarding climate change. About 77% of EU citizens acknowledge climate change as a serious issue. However, only 58% believe that the

adoption of renewable energy, enhancement of energy efficiency, and acceleration of the green economy transition should be expedited.[24]

3.2 Support for and Against Climate Policies

A recent survey by researchers from Oxford University, Humboldt University Berlin, and Hertie School Berlin reveals that the EU's 2035 ban on new petrol and diesel cars, often referred to as the "combustion engine ban," — to be reviewed in more detail later in the study — is the least popular climate policy in Germany, France, and Poland. This policy, part of the broader EU strategy to achieve climate neutrality by 2050, was adopted despite widespread opposition, including from voters of centre-left parties that generally support climate measures. The survey, which included 15,000 respondents from the three countries, ranked this ban lowest among 40 climate policies. Other unpopular measures included increased CO2 levies and road tolls for non-electric vehicles.

Conversely, policies that do not directly affect consumers, such as higher government investments in public transport and environmentally friendly heating in public buildings, were among the most popular. The study indicates that while there is significant support for climate action, measures that impose direct costs or lifestyle changes on individuals face substantial resistance. The authors of the survey suggest that public investment in green infrastructure and redistributing revenues from carbon pricing could help increase public acceptance of more stringent climate policies.[25]

4 Strategic Approaches to the Net-Zero Transition

This section explores the European Commission's "Green Deal Industrial Plan for the Net-Zero Age," unveiled in early 2023, which aims to position the EU as a global leader in the clean energy economy. The plan outlines a strategy focused on simplifying regulations, increasing funding access, addressing labour shortages, and enhancing trade to support the green transition. Key legislative measures include the Net-Zero Industry Act and the Critical Raw Materials Act. The section also critically assesses the plan's reception, financial strategies, and comparisons with the USA's Inflation Reduction Act. Additionally, it discusses China's dominance in green technologies, the challenges this poses for the EU's industrial strategy, and the industry's perspective, including calls for a more ambitious and competitive European Industrial Deal as articulated in the Antwerp Declaration.

4.1 The Green Deal Industrial Plan: Key Pillars

The European Commission's "Green Deal Industrial Plan for the Net-Zero Age" was unveiled in early 2023.[26] Pitched as an enabler of the Green Deal push, it outlines an ambitious strategy to position the EU as a global leader in the clean energy economy. The plan emphasises the substantial economic and industrial transformation expected globally, particularly in clean energy technologies and is structured around four key pillars. Firstly, it seeks to establish a simplified and harmonised regulatory environment across the EU to create a conducive business climate. Secondly, it aims to increase access to both public and private funding for net-zero projects. Thirdly, the plan focuses on addressing labour shortages and enhancing skills in green technologies through education and training initiatives. Finally, it emphasises the importance of open trade and resilient supply chains to support the green transition.

Several regulatory and legislative measures are proposed to support these pillars. The introduction of the Net-Zero Industry Act (NZIA) aims to simplify regulations for key technologies such as batteries, wind turbines, and solar panels. Additionally, the Critical Raw Materials Act (CRMA) seeks to secure the supply of essential materials through diversification and recycling. More concretely, NZIA proposal targets 40% EU manufacturing of clean technologies by 2030, improves permitting processes, supports strategic projects, and establishes Net-Zero Industry Academies. CRMA, meanwhile, focuses on securing and diversifying supplies of critical raw materials within the EU, setting extraction, processing, and recycling targets for strategic materials like lithium and nickel. There is also a proposal to reform the electricity market to lower costs and boost renewable energy production.

Financial instruments and state aid are crucial components of the Industrial Plan. The EU would utilise funds from the Recovery and Resilience Facility, Horizon Europe, and the Just Transition Fund to support the green transition. Furthermore, the Commission proposed temporary flexibility in state aid rules to accelerate investment in strategic

sectors. Furthermore, the plan entails a strong emphasis on upskilling and reskilling the workforce to meet the demands of the green transition. Initiatives such as the European Skills Agenda and the establishment of Net-Zero Industry Academies are intended to equip the workforce with the necessary skills for emerging green industries.

Finally, the plan underscores the importance of global trade and partnerships. Strengthening trade agreements and developing new forms of cooperation, such as the Critical Raw Materials Club, are essential for securing the inputs critical for the green transition. The EU aims to maintain its position as a leader in net-zero technologies through fair and open trade secure its place in the new net-zero economy, thereby creating jobs, rejuvenating industrial bases, and reducing costs for businesses and consumers.

Critical Assessment of the Green Deal Industrial Plan

Despite the all-encompassing effort to outline the EU's strategic direction of achieving the Green Deal milestones, the Industrial Plan has faced notable critique. The ECR Group's in the European Parliament MEP and Chair of the Parliament's Budget Committee Johan Van Overtveldt said in advance of the Green Deal funding plans that "We are absolutely in favour of a more circular economy, but we are against the recycling of promises and money. Creative accounting and financial adventures will not get the Commission very far towards finding the one trillion euros needed to fund their new climate and energy plans."[27] Meanwhile European People's Party (EPP) criticised the Industrial Plan as being overdue and insufficient. MEP Christian Ehler, EPP Group's coordinator of the industry (ITRE) committee in the European Parliament, argued that the plan should have been implemented four years ago and highlights its limitations, particularly its heavy regulatory approach. Instead, he called for a greater support for industrial competitiveness, investment incentives, and a focus on digital transition as well as for better coordination of financial instruments and increased funding for research and innovation to ensure European industry can meet its sustainability and competitiveness goals.[28]

The EU's Green Deal Industrial Plan has been criticised for its lack of specificity and strategic focus. Industry groups at the time of unveiling expressed frustration over the plan's vague definitions of clean technologies, which leaves key sectors like nuclear energy uncertain about their inclusion.[29]

Financial aspects more broadly have also been a point of contention. The reliance on national subsidy schemes has raised concerns about creating an uneven playing field, benefiting wealthier countries like Germany and France disproportionately. This approach, critics warn, risks igniting a subsidy race and undermines the goal of a cohesive European industrial strategy.[30]

Regarding financing, one notable critique centres around the fact that the EU has been repurposing existing financial frameworks rather than introducing fresh funds. The use of unspent funds from the EUR 800 billion recovery package and the REPowerEU initiative's EUR 20 billion in new grants is seen as inadequate. Critics argue that this approach fails to address both traditional priorities and new challenges effectively.[31] However, it must be noted that seven EU Members — the Czech Republic, Denmark,

Finland, Austria, Ireland, Estonia, and Slovakia — had opposed the European Commission's plan for new EU funding to support green industries, whilst another three — Germany, the Netherlands, and Belgium —, whilst not signatories of the letter, also pitched in, arguing that existing funds, namely, the EUR 800 billion post-pandemic recovery and resilience fund has sufficient unused grants and loans to address the needs.[32] This situation highlights the broader difficulty in achieving consensus within the EU, as member states have diverging views on how to best support green industries and address subsidy competition from the US and elsewhere.

USA's Inflation Reduction Act Favoured Instead

EU is not alone in trying to support green policies via concrete budgetary allocations. Indeed, USA was first. The Inflation Reduction Act (IRA) of 2022, signed into law by President Biden on August 16, 2022, represents a landmark effort in American legislative history, particularly in the domains of clean energy, healthcare, and tax reform. The IRA dedicates approximately $369 billion to energy security and climate change initiatives, marking the largest investment in these areas by the U.S. government. It includes substantial investments in renewable energy sources such as wind, solar, and nuclear power, alongside various tax incentives aimed at encouraging individuals and businesses to adopt clean energy technologies. These incentives cover a wide range of activities, from purchasing electric vehicles to installing solar panels and developing large-scale clean energy projects.[33]

More concretely, the Inflation Reduction Act (IRA) extends the Production Tax Credit (PTC) and Investment Tax Credit (ITC) for renewable energy through 2023 and 2024, after which they will be replaced by technology-neutral, emissions-based credits known as the Clean Electricity PTC and ITC. These credits aim to drive the deployment of wind and solar energy, promote investment in disadvantaged communities, and ensure the creation of well-paying jobs. Additional bonus credits are available for projects that meet prevailing wage and apprenticeship requirements, use domestic materials, or are located in energy communities. The IRA also establishes a $27 billion Greenhouse Gas Reduction Fund administered by the Environmental Protection Agency to finance clean energy and climate projects, particularly benefiting low-income and disadvantaged communities as part of the Justice40 Initiative. Furthermore, the Act provides $40 billion in loan authority to the Department of Energy for innovative clean energy projects, supported by $3.6 billion in credit subsidy for loan guarantees under section 1703 of the Energy Policy Act, encompassing renewable energy, carbon capture, nuclear energy, and critical minerals processing.[34]

In sum, the IRA is an ambitious plan to concretely finance the US green transition through dedicated funding. However, there are other reasons why IRA is favoured. European energy executives are increasingly drawn to the IRA due to its straightforward and attractive incentives, contrasting sharply with the European Union's more complex and restrictive policies. Executives highlight the IRA's simplicity and broad investment possibilities, which are driving significant capital towards the U.S.[35]

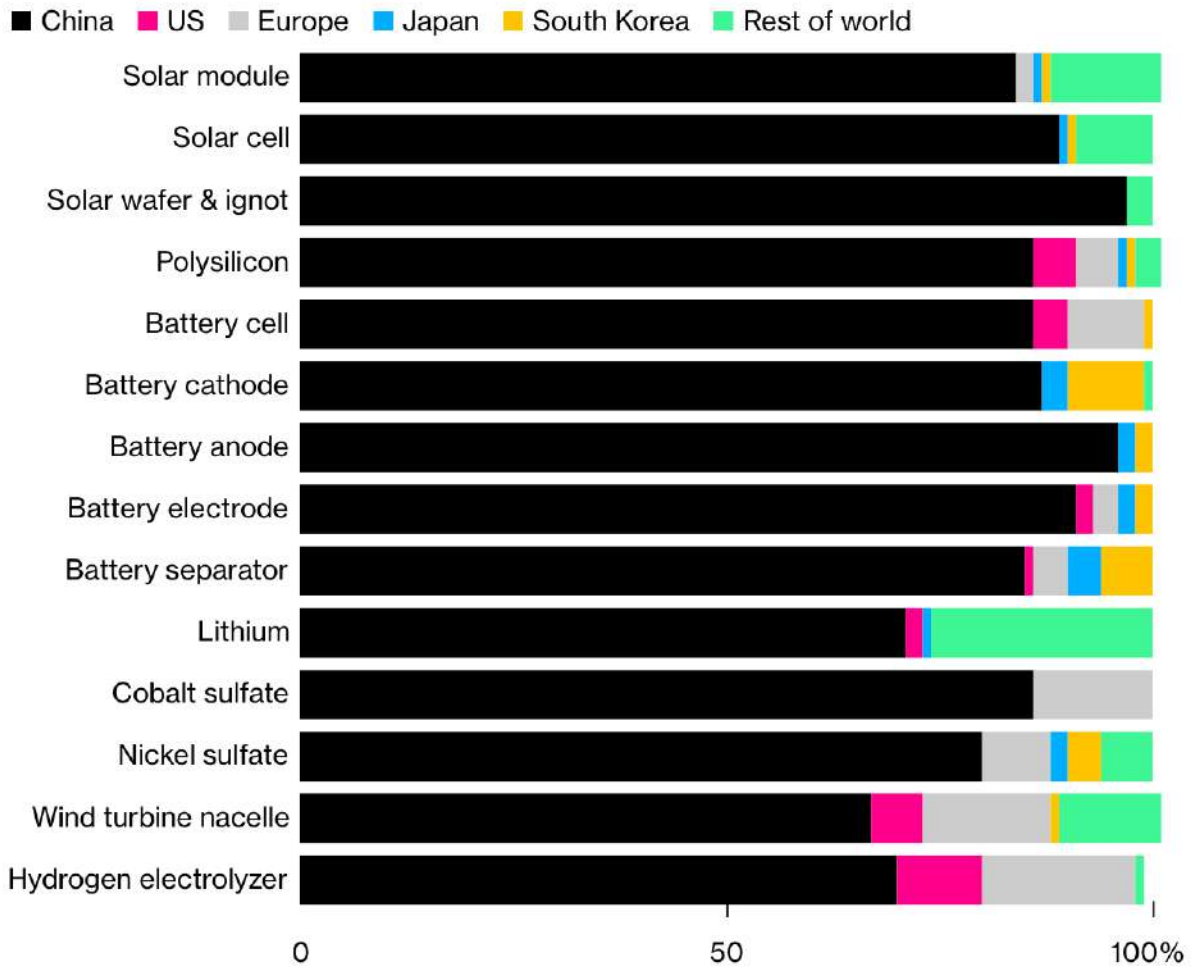
This clarity, backed by substantial funding, is drawing significant investment away from Europe. European firms like Northvolt, Polestar and Iberdrola are even considering

shifting their focus to North America[36] — while cutting expansion plans in the EU, in the case of Northwolt.[37] While the EU attempts to enhance its financial support, the U.S. approach, which combines clear incentives with the potential for penalties, effectively mirrors China's successful industrial strategies (to be discussed later). The IRA's design offers predictable, tangible benefits, encouraging rapid investment and development, unlike the more cumbersome regulatory environment in Europe. Consequently, European firms are calling for the EU to move from a punitive regulatory stance to one that incentivises green investments, mirroring the success of the IRA in attracting investment and accelerating green infrastructure development.[38] This trend underscores the broader necessity for the EU to streamline its policies in order to stay relevant in the green transition efforts.

China's Lead and Dominance in Green Tech

While the US approach provides a contrasting framework, China's advancements present a different set of challenges for the EU's green strategy. Even if the US

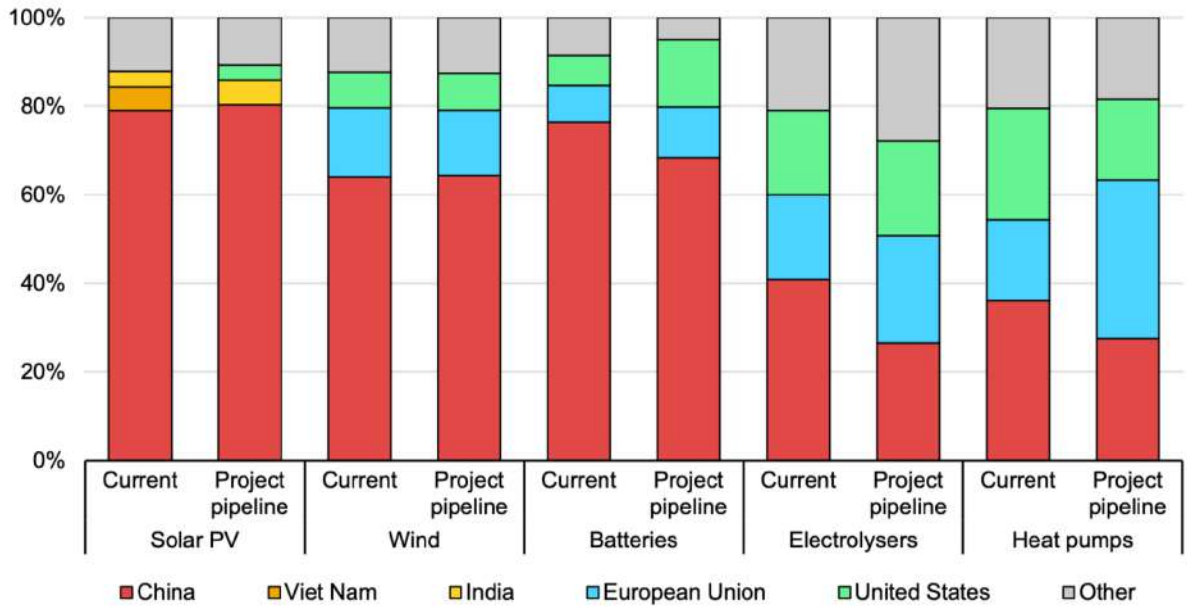
China Leads US and Europe in Clean Technology Supply Chains



Source: BloombergNEF

outpaces Europe, it still struggles to compete with China's dominance in clean-tech manufacturing. China is surging ahead, expanding its share of global production capacity in key clean-energy sectors such as battery components, metals refining, and hydrogen electrolysers. China's global production capacity now exceeds 80% in 11 essential technologies, including solar wafers and lithium-ion battery components.[39] Consequently, as the US and Europe grapple with high borrowing costs, sluggish permitting, and long waits for grid connections, raising doubts about the fruition of many announced projects, China remains well ahead. As Wopke Hoekstra, the EU's Climate commissioner notes, "We're getting more dependent on China in our quest to become greener, which is problematic."[40]

Geographical Distribution of Manufacturing Capacity for Key Clean Technologies: Current and Projected Trends



Source: IEA, as cited in Bian et al. (2024)

China's lead in green technologies and, no less importantly, control over vital supply chains should not be underestimated. The country's success is largely driven by strategic government policies supporting new industries and the entrepreneurship within its private sector. For example, China's dominance in lithium-ion battery manufacturing for electric vehicles (EVs) was propelled by declining lithium prices, government subsidies for EVs, and clear strategic directives that attracted significant investment. Similarly, China's extensive investments in solar panel and wind turbine manufacturing were bolstered by demand-side policies such as feed-in tariffs, loan guarantees, and tax credits, along with robust public support for research and development.

Photovoltaic (PV) and battery manufacturing operations warrant special attention as they are crucial to the EU's plan to phase out internal combustion engine (ICE) vehicles.

An analysis of major project announcements for solar PV and battery manufacturing in 2023 reveals that the majority are concentrated in China, followed by Europe. However, many of these European operations are still led by Chinese or US companies, such as CATL and Tesla.[41]

The Chinese dominance raises several concerns, particularly regarding the resilience and robustness of global supply chains. The concentration of relevant supply chains in- and by China poses significant risks of disruption due to geopolitical tensions or localised extreme weather events, which could have far-reaching implications for global energy security. From the European Union's perspective, this reliance on Chinese supply chains is particularly troubling.[42]

What is more, the Chinese are increasingly making inroads into Europe through manufacturing. Recently, two Chinese companies have announced plans to produce electrolysers — technology essential for generating green hydrogen — in Europe. Guofu Hydrogen intends to establish a factory in Germany, while Peric has signed a licensing agreement with a Swedish company. Fredrik Mowill, chief executive of Hystar, suggests that this move is a strategic effort to avoid potential backlash against Chinese technology. He noted in the Financial Times, "I think the main motivation is to say, 'Hey, this is made in Europe, not made in China'."[43]

4.2 Critical Raw Materials Act

The EU has expressed concerns about the potential for China's dominance to impact the stability and security of supply for critical materials essential for the green energy transition. Its partial response lies in recent legislative developments, such as the Critical Raw Materials Act (CRMA), itself a component of the aforementioned component Green Deal industrial plan‘s first pillar.

A critical focus of CRMA is reducing dependency on non-EU countries, particularly China, by fostering diversified and resilient supply chains to mitigate geopolitical risks. This regulation aims to address immediate supply vulnerabilities and set the foundation for long-term strategic autonomy and sustainability. Within the context, the Critical Raw Materials Act introduces the concept of Strategic Raw Materials (SRMs), which are crucial for strategic technologies and are vulnerable to shortages.

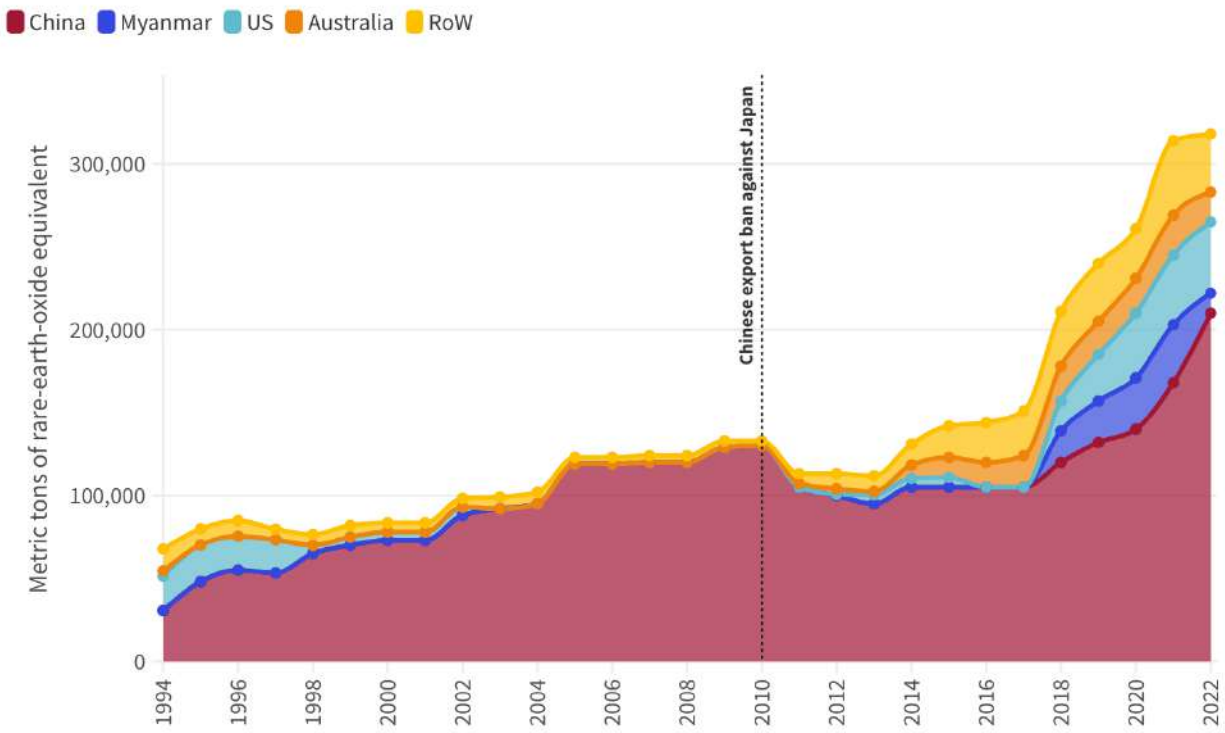
The regulation pursues several key objectives: strengthening the entire SRM value chain, diversifying the EU's imports of SRMs so that by 2030, no third country provides more than 65% of the EU's annual consumption of any SRM, improving the EU's ability to monitor and mitigate CRM supply risks, and ensuring the free movement of CRMs and products containing CRMs in the EU market while maintaining high environmental protection standards.

To achieve these goals, the regulation sets forth several measures, including enhancing domestic production and processing capacities, promoting the recycling and circularity of CRMs, and establishing strategic projects to secure the supply of SRMs. Additionally, the regulation aims to streamline permitting processes for CRM projects, making it easier to develop new supply chains within the EU.[44]

Critical Raw Materials Act: A Welcome Step, But Not Enough

Despite making the steps in the right direction, CRMA is not without its flaws. Firstly, the Act does not allocate new funds, relying instead on existing budgets and instruments such as InvestEU, the European Investment Bank's administered programme. This lack of new funding potentially undermines its ability to attract the necessary private investments, casting doubt on the feasibility of its ambitious goals. Additionally, the Act lacks a detailed schedule for securing new supply sources. Without a concrete plan to diversify import routes, Europe remains vulnerable to geopolitical risks and supply disruptions, particularly from China, which, as discussed

Global Rare Earths Mining Production Trends, 1994-2022



Source: Bruegel

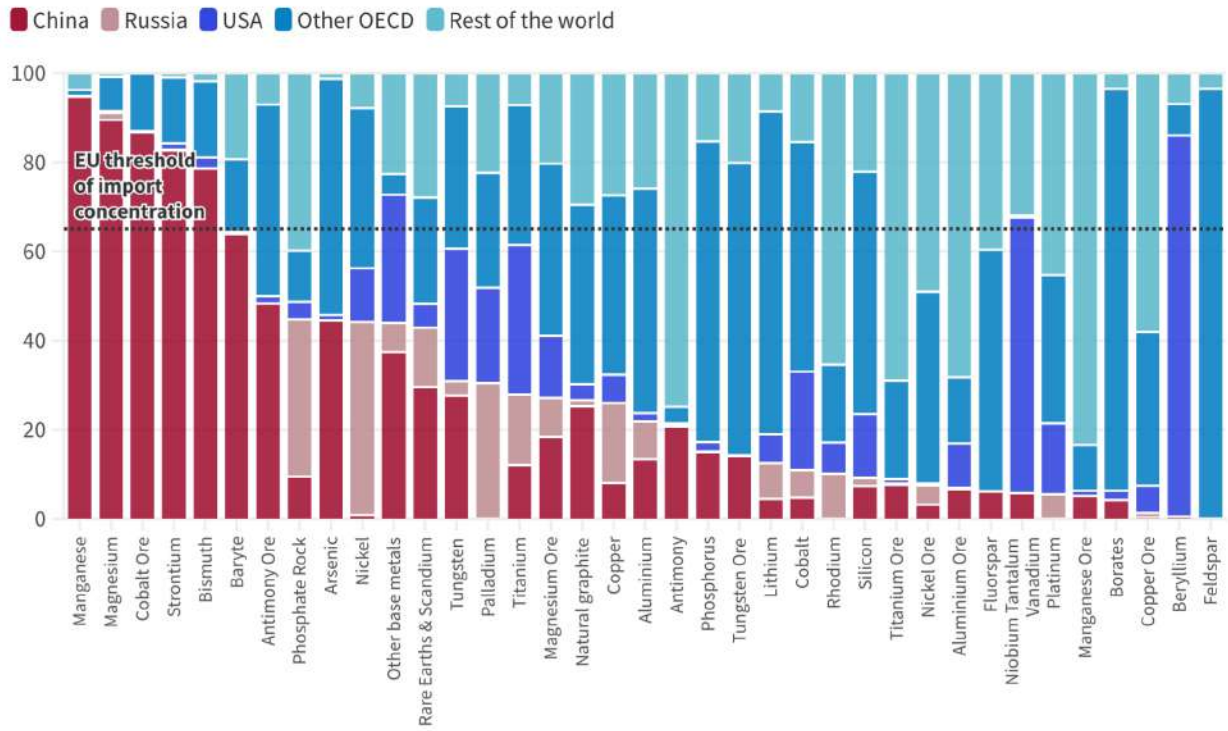
earlier, dominates the supply of many critical raw materials.[45]

The proposed measures to streamline permitting processes within Europe are also insufficient. The delays in developing mining projects are largely due to underinvestment in the exploration and preparation phases, not just bureaucratic red tape. Accelerating permitting without addressing these underlying issues could lead to environmental and human rights violations, public opposition, and legal challenges. Moreover, the Act does not present a compelling business case for investing in a European value chain. High-risk, time-consuming projects like mining and refining require significant capital and extended periods to become operational. The focus on

faster permitting and contingent financial assistance does not adequately mitigate these risks or attract private sector engagement.[46]

The Act's external diversification strategy remains largely declaratory. It mentions new trade agreements and partnerships but lacks specifics on securing necessary funding and effectively managing geo-economic risks. The proposed Critical Raw Materials Club lacks clarity on implementation and strategic response mechanisms, further diminishing its potential impact. Meanwhile mining industry executives have expressed

Country of Origin of EU Critical Raw Material Imports in 2021



Source: Bruegel

skepticism about the plan, arguing that the diversity of mineral demand and the complexity of processing logistics make the initiative impractical. They suggest focusing more on recycling and exploring domestic mineral deposits.[47]

Others also note that without a more international approach CRMA will fail to deliver. In particular, it is argued that boosting domestic production, refining, and recycling of CRMs within the EU is not enough as these measures are deemed insufficient to address the fundamental issue of global supply chain bottlenecks. The Act's targets will not significantly mitigate the EU's indirect exposure to concentrated CRM markets.[48]

It can be thus argued that while the EU's Critical Raw Materials Act is ambitious in its objectives, it does not meet the magnitude of the challenge. The EU needs to mobilise

substantial public funding, enforce diversification requirements for companies, and strengthen its external trade strategies with concrete resources and actionable plans to ensure economic resilience and its stated strategic autonomy.

4.3 Net-Zero Industry Act (NZIA)

The Green Deal Industrial Plan also includes the Net-Zero Industry Act (NZIA), building on earlier initiatives, such as the 'Fit for 55 package' and the REPowerEU plan, which aimed to reduce dependency on Russian fossil fuels and accelerate renewable energy adoption. The proposal was announced by Commission President Ursula von der Leyen in January 2023 and formally introduced in March 2023 without an impact assessment or public consultation due to urgency.

The NZIA establishes a framework to enhance the EU's net-zero technology manufacturing ecosystem. It specifies measures to ensure that by 2030, the EU achieves a manufacturing capacity for a number strategic net-zero technologies covering solar, wind, battery/storage, heat pumps, electrolysers, biogas/biomethane, carbon capture and storage, and grid technologies. The regulation proposes a streamlined permit-granting process with specific time limits to facilitate swift project approvals. It also introduces 'net-zero strategic projects' that will receive priority status and expedited processing.

Member States are required to designate a competent authority to facilitate the permit-granting process and provide administrative support to net-zero technology projects, particularly SMEs. The regulation includes provisions for setting up 'net-zero Europe platforms' and regulatory sandboxes to foster innovation and investment. The Commission is tasked with providing guidance on assessing the sustainability and resilience contributions of these technologies.[49]

The NZIA thus represents a significant step towards striving to reduce the EU's dependency on third countries for key clean energy technologies and achieving its climate goals. Through devising a more robust manufacturing ecosystem for net-zero technologies, it aims to enhance the EU's energy resilience, create quality jobs, and promote sustainable industrial practices. Indeed, the situation in Europe for many relevant sectors is urgent. For instance, EU solar manufacturers claim they are in an existential crisis due to Chinese subsidies that have flooded the EU market with cheap solar panels, causing bankruptcies.[50]

However, with other climate-related initiates discussed earlier, it is not without its shortcomings and fails to deliver on similar themes. The primary concern is the protectionist nature of the policy objectives, which aim for significant import substitution of specific manufacturing products rather than reducing dependency on a single trading partner for security reasons. This is seen as a bid to protect and expand the EU's clean tech industrial output at a massive scale. The draft's tools for achieving these objectives, reminiscent of failed industrial planning strategies from the 1960s, include setting a minimum domestic production target for clean technologies at 40% of EU deployment by 2030, a drastic increase from current levels; an approach is criticised for being inefficient and costly.[51]

Major Project Announcements for Solar PV and Battery Manufacturing in Q1 2023

Company	Location	Country	Production capacity	Projected completion year/year reaching maximum throughput
Batteries				
Tesla	Austin	US	200 GWh	2024/2025–2030
CATL	Yibin	China	186 GWh	Operating/>2030
CATL	Fuding	China	120 GWh	Operating/2025–2030
LGES	Wroclaw	Poland	115 GWh	Operating/2025
CATL	Debrecen	Hungary	100 GWh	2025/2028
LGES	Nanjing	China	92 GWh	Operating/>2030
CALB	Changzhou	China	90 GWh	Operating/2025–2030
Tesla	Berlin	Germany	85 GWh	2024/>2030
CATL	Luoyang	China	80 GWh	2025/2025–2030
Solar PV				
Jinko Solar	Yuhuan	China	30 GW	2024/2025
Solar grids	Zhuhai	China	30 GW	2024/2024
Tongwei	Yancheng	China	25 GW	2023/2023
Tongwei	Nantong	China	25 GW	2023/2024
Jinko Solar	Shangrao	China	24 GW	2023/2025
LONGi	Taizhou	China	20 GW	Operating/already at maximum
LONGi	Wuhu	China	20 GW	2023/2025
Trina	Yancheng Dafeng	China	20 GW	Operating/2024
Suntech	Chuzhou Fengyang	China	20 GW	2023/2024
REC Group	Jamnagar	India	20 GW	2023/2026
Solar grids	Yiwu	China	20 GW	2024/2024
Hoshine	Urumqi	China	20 GW	2023/2026
Royal	Fuyang	China	20 GW	2023/2025

Notes: 'major projects' refer to plants with stated production capacity by 2030 greater than or equal to 20 gigawatts (GW) per year for solar PV modules and 80 GWh per year for EV batteries. Any anticipated expansions beyond 2030 have not been included. The battery manufacturing facilities include all kinds of chemistries, both for mobility as well as stationary applications.

Source: IEA, as cited in Bian et al. (2024)

The above-discussed relevant production targets for net-zero technologies are also deemed unrealistic due to a lack of necessary instruments to meet these objectives for not fundamentally changing the existing conditions. For instance, the set deadlines for

permitting procedures, although intended to expedite new manufacturing sites, are not seen as decisive factors influencing investment decisions. Moreover, the new "sustainability and resilience" criteria for public procurement and renewable energy auctions can be ignored if they result in significant additional costs, potentially negating their intended benefits. The substantial cost difference between European and Chinese solar panels exacerbates this issue, making the criteria impractical to enforce. While the provision for cybersecurity pre-qualification could block market access for Chinese manufacturers, its implementation details remain uncertain.[52]

A position paper by Jacques Delors Centre argues succinctly that through NZIA the EU is fundamentally unable to provide a constructive response to the resurgence of industrial policy for three reasons. First, the EU lacks the analytical capacity and political will to establish meaningful industrial policy priorities. Second, it does not possess the regulatory mechanisms to support targeted industries. Third, it lacks the financial resources to leverage the European market's scale and achieve its objectives without undermining fair competition.[53] Overall, the experts suggest that the NZIA, in its current form, does little to advance Europe's manufacturing capabilities for green technologies.

4.4 Alternative Perspectives on the Green Deal Initiatives

The Antwerp Declaration

Underwhelmed by the European Green Deal policies, industry has called for a more ambitious approach. Over 1,000 organisations spanning 25 sectors support this the Antwerp Declaration which calls for a European Industrial Deal to complement the EU Green Deal and safeguard quality jobs in Europe. In essence, the Antwerp Declaration calls for a comprehensive industrial strategy to enhance competitiveness, secure supplies, reduce energy costs, and increase demand for green products, ensuring Europe's leadership in the global clean energy economy. It is important to briefly outline the specific calls in more detail.

The industry stresses the need for a more competitive and coherent action plan, urging for streamlined regulations and reduced legislative complexity. This is essential for creating a predictable business environment and attracting green technology investments.

A robust public funding strategy, including a Clean Tech Deployment Fund for energy-intensive industries, is crucial. This fund should be coordinated with a simplified State Aid framework to ensure fair competition and support investments in clean technologies. Furthermore, high energy costs in Europe remain a concern for the industry. Thus the Antwerp Declaration calls for a real EU Energy Strategy prioritising affordable low-carbon energy, including renewable and nuclear power, is needed. Infrastructure development, supported by the Recovery and Resilience Facility, should focus on energy, digital technology, carbon capture, and recycling.

Securing and diversifying the supply of critical raw materials is noted as vital. The industry advocates for increased domestic mining, sustainable processing, and recycling, along with new global partnerships and free trade agreements to ensure supply security. Additionally, boosting demand for net-zero and circular products through transparent carbon footprints and public procurement initiatives is also deemed essential; thus call for expansion of the Net Zero Industry Act and Critical Raw Materials Act is believed to be supportive of this effort. Lastly, integration of the Single Market for waste, recycled materials, and energy is perceived as necessary for efficient value chains. The industry calls for a smarter innovation framework that fosters high-quality science, technological advancements, and digitalisation.

As the Declaration states towards the end, "Only with a strong industrial fabric and strengthened social dialogue in Europe can we ensure that the green transition will be a Just Transition."[54]

Strategy vs. Competitiveness: EU's Approach Under Scrutiny

Stefano Mallia, president of the Employers' Group in the European Economic and Social Committee, argues that the EU's initial response to the US's Inflation Reduction Act, involving substantial subsidies for American industry, falls short of addressing long-term competitiveness. Despite ticking several boxes like regulatory framework and access to funding, the EU's plan is seen as a work in progress by European employers. Concerns include the need for a focus on the digital transition, the potentially divisive nature of subsidies, and the risk of temporary measures becoming permanent. Mallia critiques the "pick the winner" approach of the EU's strategy and emphasises the need for political will to prioritise competitiveness, pointing out that the EU's share of global GDP has declined, with European firms lagging behind their US counterparts in growth and R&D.[55]

Other stakeholders, whilst more sympathetic, still find room for improvement. Transport and Environment, a green transportation interest group, asks for further reducing red tape by simplifying permitting processes for battery value chain projects while ensuring strong social and environmental safeguards.

The need for increased competitiveness is not lost on the EU. Much of the Von Der Leyen's latest State of the European Union speech in 2023 focused on competitiveness, not anymore merely on green agenda.[56] Furthermore, the European Council on 30 June 2023 commissioned an independent High-Level Report on the future of the Single Market to be presented in March 2024. They appointed former Italian Prime Minister Enrico Letta to write this report and tasked the incoming presidencies of the Council and the Commission with advancing this work in consultation with Member States.[57]

The Letta Report

The Letta report, a product of extensive consultations and reflections across Europe and spanning 147 pages, underscores the importance of a more integrated and comprehensive strategy to boost competitiveness within the Single Market. Presented at the April 2024 European Council, it argues for a shift towards policies that enhance innovation, scalability, and resilience of European industries. Titled "Much More than a

Market", it identifies several key areas where the EU must focus its efforts, which are worth discussing in more detail:

- Innovation and Digital Transformation: The Letta report emphasises the need for a fifth freedom within the Single Market, focusing on research, innovation, and education. By embedding these elements at the core of the Single Market, the EU can foster an ecosystem that drives economic vitality and societal advancement.
- Scaling Up EU Companies: The report highlights the critical gap between EU companies and their global counterparts, particularly in the US and China. To bridge this gap, the EU must support the scalability of its companies within the Single Market, enhancing their ability to compete globally and attract foreign investment.
- Regulatory Simplification: A recurring theme in both the Antwerp Declaration and the Letta report is the need to simplify regulatory frameworks. The report advocates for the codification of a European Code of Business Law to provide a unified regulatory regime that supports free movement and reduces barriers for SMEs.
- Energy Strategy and Infrastructure Development: The Letta report echoes some of the earlier industry calls which stress the importance of a resilient and integrated energy market to support industrial competitiveness.
- Supply Chain Security: Echoing the existing regulatory initiatives discussed earlier in this study, the Letta report calls for a secure and diversified supply of critical raw materials.[58]

However, with the above in mind, The Letta report raises questions about how its proposed ideas can be reconciled with the Green Deal initiatives. For instance, while the Green Deal places a significant emphasis on stringent environmental regulations and renewable energy, the Letta report highlights the necessity of a more flexible approach to energy policy. It advocates for the inclusion of nuclear power alongside renewable sources to ensure affordable energy, which may not fully align with the Green Deal's focus on renewables. This discrepancy underscores a fundamental tension between ensuring energy affordability and meeting ambitious environmental targets.

Additionally, the Letta report's call for robust public funding strategies, such as a Clean Tech Deployment Fund and a simplified State Aid framework, points to a need for greater flexibility in financial support mechanisms. This approach contrasts with the Green Deal's stringent criteria for funding allocation, potentially creating conflicts in balancing economic competitiveness with environmental sustainability. The report's emphasis on securing and diversifying the supply of critical raw materials through inter alia global partnerships may also pose challenges to the Green Deal's environmental sustainability goals. These examples illustrate the ongoing challenge of reconciling industrial and competitiveness strategies with the EU's environmental ambitions. However, given that the Letta report was commissioned by the Council at the request of Member States, it is already shaping the EU's legislative agenda for the next five years. Member States are likely to increasingly challenge the green agenda, particularly if it is perceived to undermine industry, competitiveness, and economic growth.

5 Case Study: Evaluating the Green Transition's Impact on the Automotive Sector

This section explores the European Parliament's recent approval of the 2035 ban on new internal combustion engine (ICE) vehicles, a pivotal element of the "Fit for 55" package. It examines the contentious nature of the vote, the legislation's goals for CO2 emissions reduction, and the subsequent concessions allowing the sale of ICE vehicles powered by synthetic or e-fuels. The section also delves into the challenges and criticisms surrounding this ban, including the feasibility of scaling up electric vehicle (EV) production, the impact of rising car prices, and the infrastructure needs for EVs and hydrogen fuel cell vehicles. Additionally, it addresses the political pushback against the ban and the broader implications for EU climate policy and market dynamics.

5.1 Transportation and Cars: The 2035 Internal Combustion Engine Ban

In early 2023, the European Parliament approved new CO2 emissions reduction targets for passenger cars and light commercial vehicles as part of the "Fit for 55" package. The vote was contentious, passing with a slim majority of 340 votes in favour, 279 against, and 21 abstentions. Despite the close margin, MEPs endorsed the agreement reached with the Council on revised CO2 emission performance standards, aligning with the EU's heightened climate ambitions. The new legislation, often referred to as ICE vehicle ban, aims for zero CO2 emissions from new passenger cars and light commercial vehicles by 2035, targeting a 100% reduction compared to 2021 levels. Intermediate targets for 2030 are set at a 55% reduction for cars and a 50% reduction for vans.[59]

The agreement was subsequently diluted due to opposition by Germany and other countries. Despite initial strong support, the European Commission made concessions to allow the sale of internal combustion engine (ICE) vehicles powered by synthetic or e-fuels beyond 2035. This concession came amid doubts about Europe's ability to meet its ambitious deadlines for phasing out ICE vehicles, with many governments and manufacturers expressing concerns over the feasibility of scaling up electric vehicle (EV) production in time.[60]

E-fuels are not without their challenges. The EU's stringent regulations on these synthetic fuels have sparked concerns about "CO2 tourism," a term coined to describe the potential practice of transporting liquified CO2 across continents to meet regulatory demands. German Transport Minister Volker Wissing highlights that this practice, necessary to comply with EU rules, may involve shipping CO2 from Europe to e-fuel production sites outside the EU, such as Morocco, where renewable energy is more

abundant. As critics argue, this process undermines climate protection efforts, as it contributes little to reducing emissions.[61]

Political Pushback and Reassessment

More broadly, the 2035 ban on new petrol and diesel cars is a prime example of ideological overreach that is likely to face serious reconsideration going forward. The law has a 2026 review clause, on which the Parliament will get a say. As Italian Prime Minister Giorgia Meloni told online magazine Open, "It was an ideological folly, which absolutely must be corrected."[62]

The rightward shift in the European Parliament has emboldened critics of the ban. Manfred Weber, leader of the European People's Party (EPP), declared the combustion engine ban a "mistake" and promised to push for its repeal in upcoming discussions. This stance reflects a broader sentiment within the EPP and other right-leaning factions that the EU's climate policies need to be more realistic and less restrictive. Peter Liese, the EPP's lead climate lawmaker, echoed this sentiment, stating that the election results validated his party's vision for a more balanced Green Deal. He emphasised the need to eliminate the ban, suggesting that climate policy should not come at the expense of economic pragmatism.[63]

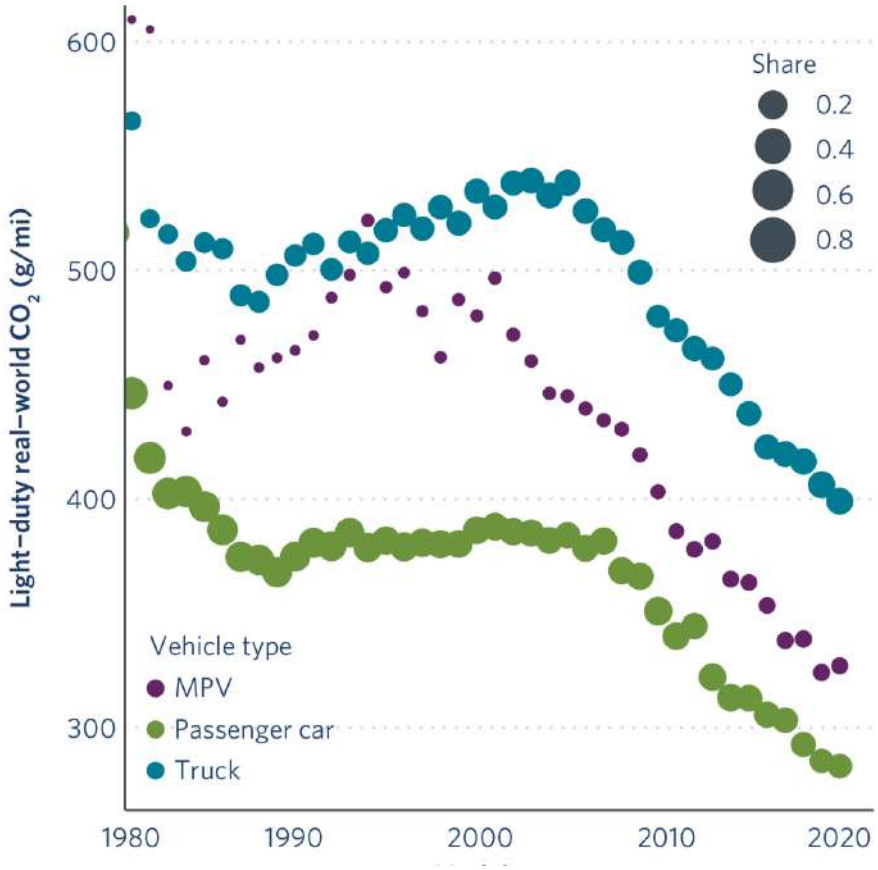
The pushback against the combustion engine ban also highlights a potential conflict with European Commission President Ursula von der Leyen, who introduced the ban and supports it. Her bid for a second term may hinge on navigating this internal conflict within the EPP and securing a broader coalition. While the ban's reversal would contradict her campaign promises, failing to address the concerns of conservative parties could potentially jeopardise her leadership.

Evaluating the Impact of Existing Vehicle Fleet on Emissions

However, from a CO2 perspective, the ICE vehicle ban initiative lacks thorough consideration. Passenger cars and light commercial vehicles (vans) account for approximately 16% and 3%, respectively, of the total EU carbon dioxide (CO2) emissions, which is a significant contributor to climate change.[64] It is crucial to understand that the introduction of new zero-emission vehicles alone will not significantly reduce emissions, as the existing fleet has a greater impact. According to the European Automobile Manufacturers' Association (ACEA), there were approximately 290 million vehicles on EU roads in 2022, with an average age of 12.3 years. In less affluent EU countries, the vehicles are even older, with average ages of 14 years in Estonia and 17 years in Greece.[65]

Older cars are characterised by less efficient technologies and increased emissions. According to the US Environmental Protection Agency, modern vehicles—including cars, sport utility vehicles (SUVs), pickup trucks, heavy-duty trucks, and buses—are approximately 99 percent cleaner for common pollutants such as hydrocarbons, carbon monoxide, nitrogen oxides, and particulate emissions compared to 1970 models.[66] The lion's share of emissions is also attributed to older vehicles. Indeed, according to International Council on Clean Transportation (ICCT), in 2010, vehicles 15 years old and older made up just approximately 14% of the fleet in the US but were responsible for exactly half of total NO mass emissions. By 2018, the percentage of the

Real World Emissions of Cars are Constantly Falling



TRUE Initiative

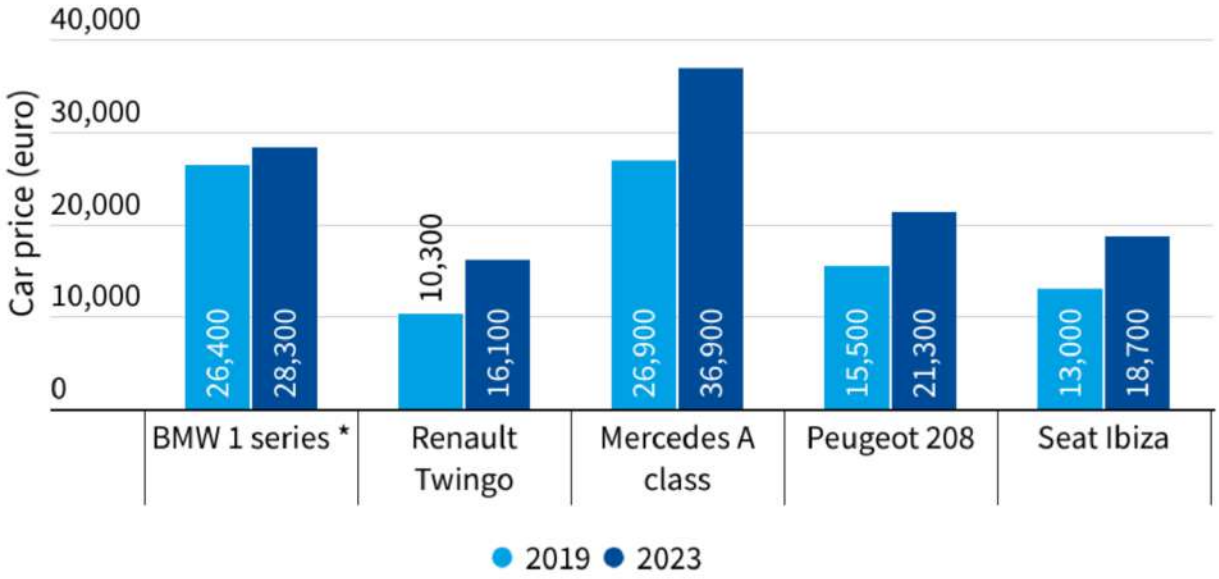
fleet responsible for half of total NO emissions had decreased to 11%.[67] The situation in Europe is comparable in Europe.

Rising Costs and the Growing Unaffordability of Cars

It is evident that newer ICE cars contribute significantly to reducing CO2 and other pollutants. However, the average age of the vehicle fleet in Europe is increasing rather than decreasing. The primary reason for this trend is the growing unaffordability of cars due to price rises.[68]

In recent years, the cost of car ownership in Europe has risen significantly, making vehicles increasingly unaffordable for many consumers. Several factors have contributed to this trend, including disruptions in the global supply chain, a shortage of critical components such as semiconductors, and a shift by manufacturers towards producing higher-end, more expensive models.[69] Recent analysis by Transport and Environment lobby group reveals a significant rise in car prices across Europe. Since 2019, the prices of the cheapest models from Europe's five largest carmakers (BMW, Mercedes, Stellantis, Renault, and Volkswagen) have increased by up to 41%, almost double the average EU cumulative inflation rate of 21%.

Prices of ICE Cars are Soaring



* The price difference for BMW is limited only due to a fall in prices since May 2023.

Source: Transport and Environment (2023)

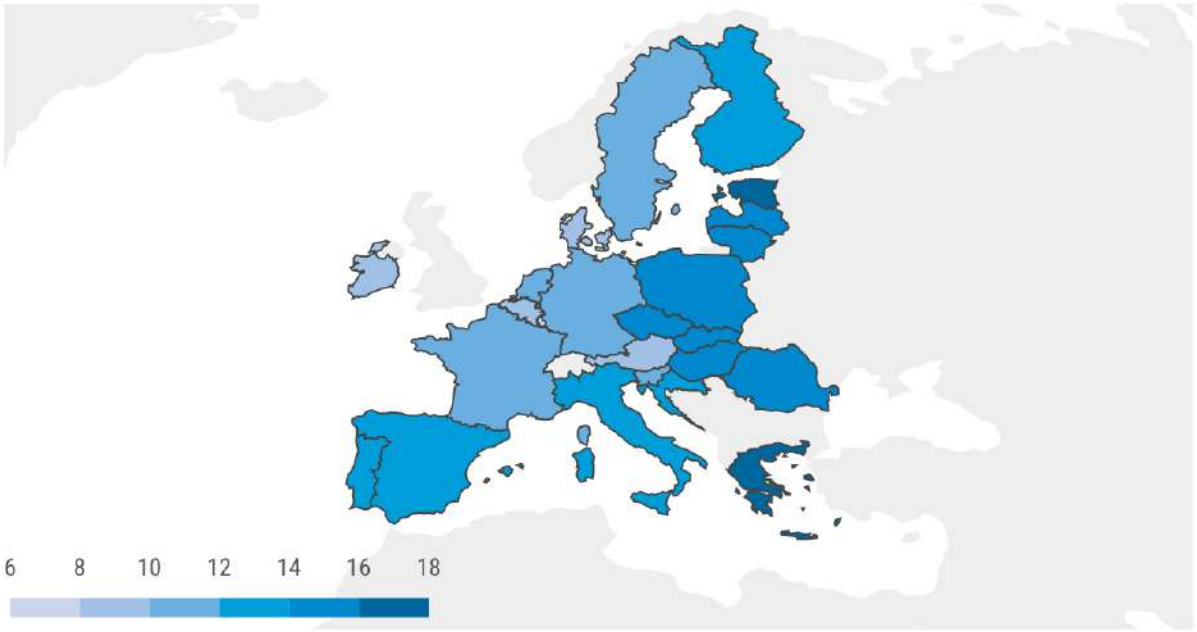
For instance, the prices of small, affordable models like the Peugeot 208, Seat Ibiza, and Renault Twingo have risen by nearly EUR 6,000. Even premium small models such as the Mercedes A and B class have seen price hikes exceeding EUR 10,000. Despite these increases, carmakers have seen their profits more than double from EUR 28 billion in 2019 to EUR 64 billion in 2022, partly by leveraging an inflationary market to boost prices beyond the actual increase in input costs. While inflation and higher raw material costs have contributed to the price rise, only about half of the increase is attributed to these factors, with the rest enhancing carmakers' profits. Recently, prices for entry-level cars from BMW and Stellantis have fallen slightly, indicating that previous hikes were also driven by profit motives.[70]

Furthermore, consumers are also grappling with rising interest rates. As Bernstein, an investment research firm, is quoted by Forbes, "Higher financing costs for consumers will generate multiple headwinds. As cars become more expensive to finance, the marginal consumer will opt to keep their current car rather than replace it at the end of the year. This reduces new car demand, negatively impacting volumes for the main auto industrial business but keeping used car prices elevated."[71] This dynamic underscores the compounded financial pressures on consumers, leading to decreased new car sales and sustained high prices in the used car market.

The trend of rising car prices, even for entry-level models, highlights the increasing financial strain on European consumers and underscores the need for measures to

make car ownership more affordable. This is important so as to ensure that CO2 reduction targets are met in line with Green Deal objectives.

Average Vehicle Age in the European Union



Source: ACEA

Challenges in the Adoption of Electric Vehicles

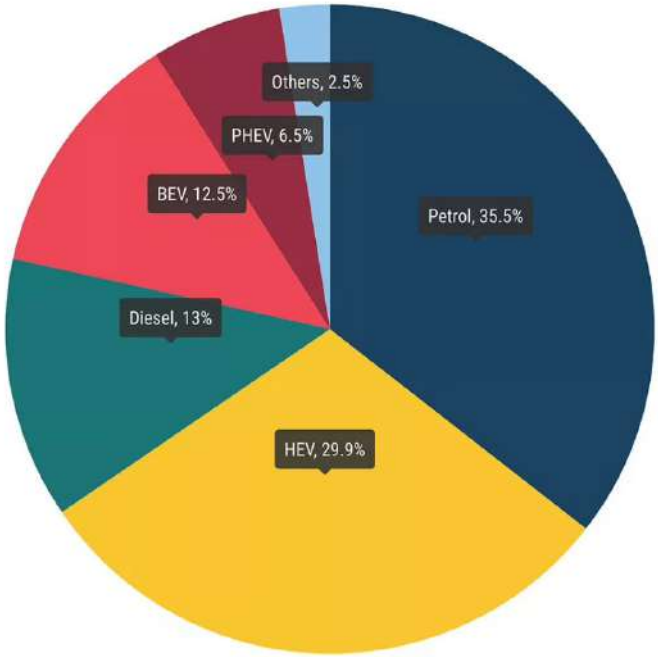
While internal combustion engine (ICE) cars are becoming increasingly unaffordable, electric vehicles (EVs) remain out of reach and unappealing for the majority of prospective car buyers in Europe. Despite expectations, Europeans are predicted to purchase nearly nine million fewer EVs between 2024 and 2030 than initially anticipated, according to a report by UBS. High prices, insufficient range, and lengthy charging times are significant deterrents. Even as EVs are projected to dominate after 2030, the current lack of affordable models is stalling their adoption. This affordability issue is exacerbated by aforementioned rising interest rates, making financing new cars more expensive. As a result, many consumers opt to retain their existing vehicles, further reducing new car demand and keeping used car prices high.[72]

Similarly, a recent Bloomberg Intelligence survey reveals that only 18% of European car buyers intend to purchase battery electric vehicles (BEVs) within the next year, favouring internal combustion engine (ICE) models and plug-in hybrids instead. This trend challenges ambitious government targets for phasing out ICE sales by 2035, with 68% of respondents supporting a delay of this deadline. Hybrids, particularly plug-in hybrids (PHEVs) and hybrid electric vehicles (HEVs), are growing in popularity, though they still represent a small market share. European carmakers are adjusting their EV

sales goals due to rising consumer apathy, which disadvantages brands like Tesla and Chinese newcomers. Key consumer concerns include insufficient charging infrastructure, range anxiety, and high prices, with 83% of respondents citing the high cost of new cars. Despite these challenges, brand loyalty remains strong in Europe, particularly for domestic brands. The study underscores the need for more robust EV infrastructure and competitive pricing to meet future EV adoption goals.[73]

The argument for increasing the number of EVs on the road now is to create a substantial pool of used EVs for future consumers. However, this strategy is faltering due to a significant lack of consumer interest in second-hand electric vehicles compared to combustion engine cars. In key markets like Germany, used EVs comprised only 1.58% of new ownership registrations by November 2023. Contributing factors include higher prices for used EVs and concerns about the range of older models. Despite advancements in battery technology, the belief that future models will be superior deters current purchases. Additionally, the EU's efforts are hindered by

May 2024 New Car Registrations: EVs Comprise Only 12.5% of Total Sales



Source: ACEA

reduced financial incentives for EV purchases, as evidenced by Germany's recent budget cuts.[74]

Contrary to earlier convictions that the EV market will only see growth,[75] their sales growth in Europe is plummeting. The overall market share for EVs in the EU fell to 12.5% in May 2024, compared to 13.8% in May 2023. Thus even the diesel market

share (13%) is larger than that of EVs. Despite strong EV growth in Belgium — a market characterised by strong corporate car culture and tax incentives for EVs[76] —, most of Europe reported fewer EV registrations.[77]

5.2 Re-evaluating EV Strategies Amidst Market Realities

Whereas the narrative used to be that EVs would become cheaper and more widely adopted, the reality of lower-than-expected car sales has led even the most committed carmakers to question their previously set EV strategies. Some carmakers are slowing down their EV rollouts, shifting focus back to their profitable internal combustion engine models, or seeking alternative ways to cut costs.[78]

For instance, Mercedes-Benz announced a postponement of its objective to transition to an all-electric vehicle lineup by 2030. The company also stated that it will continue manufacturing internal combustion engine vehicles and hybrids well into the next decade.[79] Similarly, Ford's strategic investment in hybrids — and effective reversal on EV investment in all but name — is proving successful, with the company reporting a 36% increase in hybrid sales for Q1 2024.[80] Meanwhile Fiat has confirmed that its latest 500 model, initially launched as an electric-only vehicle, will receive a combustion engine variant starting in 2026.[81] Even Tesla, the epitome of EVs and perhaps the best gauge of EV market conditions, is feeling the pinch. Data from the China Association of Automobile Manufacturers (CAAM) indicates that Tesla's Shanghai gigafactory produced 49,498 vehicles in March, a 17.7% decline compared to the previous year. In April, production further decreased by 33% year-over-year, reaching 36,610 vehicles.[82]

The push towards a sustainable automotive future is now at a crossroads, with the industry needing to balance innovation with economic feasibility. While the long-term vision for a greener, more sustainable transportation sector remains intact, the path to achieving it is proving to be more complex and uncertain than initially projected.

Impact of Affordable Chinese EVs and EU Tariff Responses

The issue is not merely the availability of cheaper EVs. In fact, Chinese and China-made EVs, including those sold by Tesla, are becoming extremely affordable and increasingly popular, with their prices undercutting those of equivalent internal combustion engine vehicles. According to an analysis by Transport & Environment, Chinese-made EVs are projected to capture 25% of the European market in 2024, up from 19.5% the previous year. This increase is driven by the rising sales of Chinese brands like MG and BYD, along with Tesla's use of its Shanghai factory to supply Europe.[83] The significant price difference is a key reason for the popularity of Chinese-made EVs in Europe. In 2023, the average price of a battery electric vehicle in Europe was approximately EUR 45,999, according to the European Commission. In contrast, Chinese EVs, like the BYD Dolphin, are considerably cheaper, costing around EUR 29,964.26, highlighting a substantial price disparity with European models.[84]

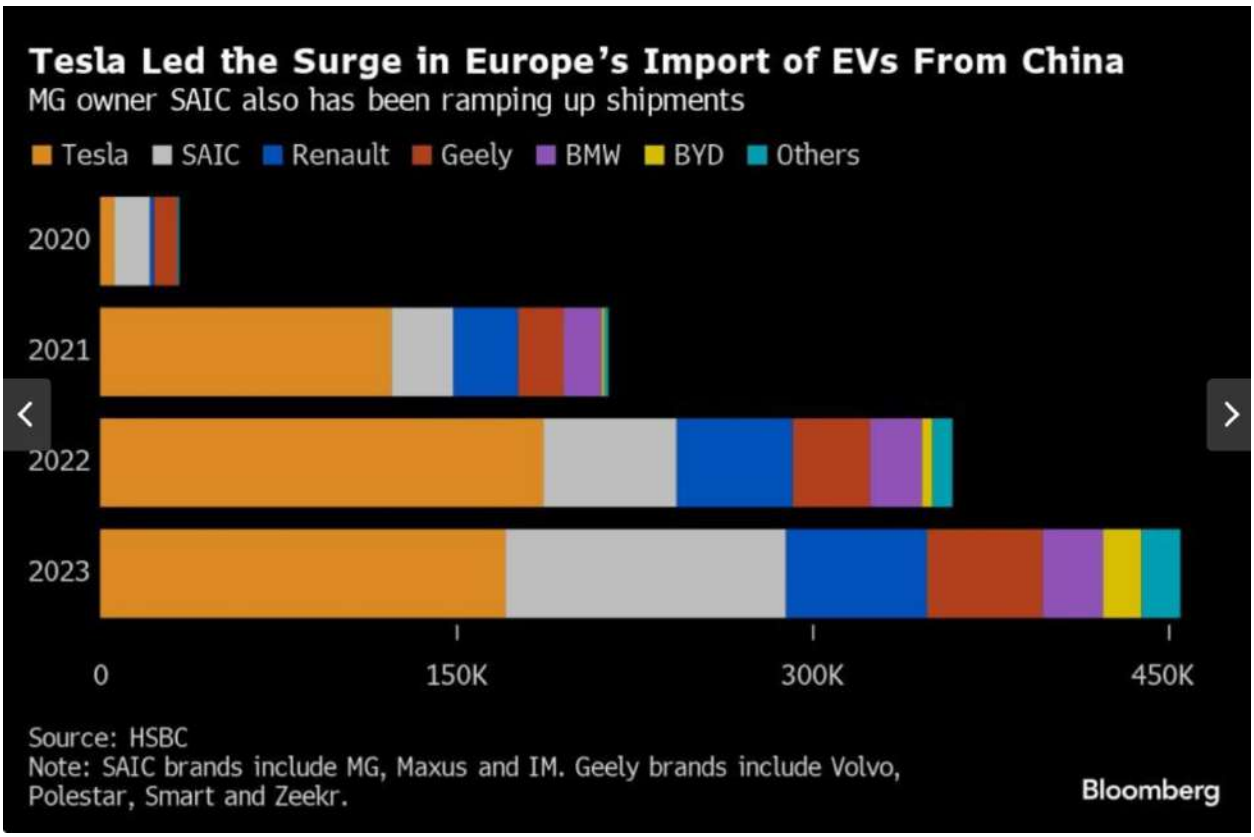
Proportion of China-Made EVs in Total BEV Sales in Europe

Source: Transport and Environment (2024)

The growing presence of these affordable Chinese EVs is raising concerns among European manufacturers about being undercut by cheaper models. As Chinese companies continue to expand, they aim to build brand recognition and eventually move into higher-end markets, further challenging established Western brands.[85] If seen from purely climate and Green Deal perspective, this is good news for governments and consumers alike. Instead, the European Union plans to increase tariffs on Chinese-made electric vehicles (EVs) due to concerns over unfair subsidies. The European Commission's investigation revealed that Chinese EVs benefit from substantial government support, harming EU competitors. As a result, provisional tariffs of up to 38.1% will be imposed, in addition to existing 10% duties. Key Chinese companies like BYD, Geely, and SAIC will face specific additional tariffs.[86] This move aims to level the playing field, but it may lead to higher prices for Chinese EVs in Europe and potential retaliation from China, affecting luxury European car brands sold there.

As critics correctly point out, the tariffs will likely hinder the EU's climate goals by limiting access to affordable EVs.[87] Additionally, there is a risk that imposing tariffs could provoke China to retaliate by placing tariffs on high-end EU-made cars. This potential backlash explains why luxury European automakers such as Mercedes and BMW oppose tariffs on Chinese EVs.[88] More importantly, this approach highlights the

Made in China EV imports to Europe by Car Brand



Source: Bloomberg

limitations of the Green Deal policy. Even if overlooking the net — as opposed to claimed — benefits of EV adoption in terms of positive contribution to climate, the EU's approach prioritises a technology in which the EU lacks a significant lead. Additionally, it raises concerns about the current affordability and viability of EVs. The geopolitical risk posed by Chinese EVs is undeniably real. However, this concern misses the mark if the stated goal is to achieve climate neutrality by prioritising EVs as the solution.

The Challenges of Hydrogen Fuel Cell Vehicles (FCEVs)

Hydrogen is increasingly seen as a key element in the transition to a sustainable energy system. Unlike fossil fuels, hydrogen can be produced using renewable energy sources, making it a potential solution for reducing greenhouse gas emissions across various sectors, including transportation. The EU's green transition foresees hydrogen as part of the solution towards a net zero economy, being especially where renewable electricity has its limits and challenges.[89]

Commonly known as Fuel Cell Electric Vehicles (FCEVs), hydrogen-powered personal vehicles are expected to play a significant role both leading up to and following the 2035 phase-out of internal combustion engine (ICE) vehicles in the EU. The European

Commission's 2020 Communication on Hydrogen Strategy highlights that the EU has supported research and innovation in hydrogen technologies for many years, bringing several technologies, including hydrogen cars, close to maturity.[90]

The reality on the ground is much different and harsher, especially compared to electric vehicles. Indeed, most car manufacturers have already given up on fuel cell electric vehicles. As an industry rule of thumb, carmakers need to sell 100,000 units a year before cost curves start falling, yet annual deliveries of hydrogen vehicles in Europe remain in the hundreds. Indeed, even in the largest European markets, Germany, there were only 263 FCEVs registered in 2023.[91] Indeed, on a global scale, only slightly over 14,400 fuel cell electric vehicles (FCEVs) were sold in 2023, marking a 30% decline compared to 2022.[92]

Major European carmakers have all but abandoned their hydrogen plans. Already in 2021 Volkswagen's CEO at the time Herbert Diess noted that the idea of a big market for hydrogen fuel cell vehicles is "very optimistic," adding that the physics behind it are "unreasonable" and that it does not even make sense for commercial vehicles due to high costs and inefficiencies. Renault and other carmakers maintain only a minimal presence in the hydrogen sector, focusing instead on electric vehicles which provide more certainty and cost-effectiveness.[93]

Mercedes-Benz has also ended its development of fuel cell-powered passenger cars, citing that they would be too expensive—around double the cost to produce compared to comparable battery-electric vehicles. Mercedes has been working on fuel cell technology for over 30 years but decided to wind down production of the GLC F-Cell, which was developed in collaboration with Ford and Nissan.[94]

At the moment, only Toyota and Hyundai appear to be still betting on FCEVs. Their success remains limited, however. At the moment, only Toyota and Hyundai appear to be still betting on fuel cell electric vehicles (FCEVs). Their success remains limited, however. Even while Hyundai has expanded its controversial hydrogen strategy, aiming to incorporate hydrogen across various sectors beyond just vehicles, the efficiency of hydrogen as a fuel source remains a significant challenge. A UK trial found that creating green hydrogen via electrolysis, compressing and storing it, then using it in a fuel cell to power a vehicle has an efficiency of 23 per cent, compared to 69 per cent for an electric vehicle (EV). This stark difference in efficiency underscores why many experts believe hydrogen is more suited to niche applications such as heavy-duty trucks and industrial processes rather than passenger cars.[95]

Toyota, in turn, has admitted that its hydrogen-powered Mirai car has not been a commercial success and is now focusing on hydrogen trucks, which face fewer refuelling infrastructure issues than passenger cars.[96] Thus even the most optimistic player in the FCEV arena is in effect giving up on the technology. The quiet phasing out of the Mirai is a living proof: Toyota has issued a bulletin to US car dealerships offering a rebate of $40,000 on its 2023 Mirai Limited fuel-cell electric vehicle (FCEV), effectively reducing the price by around 60%. This drastic price cut, which places the Mirai in the same price bracket as the Toyota Corolla, is accompanied by incentives such as $15,000 worth of free hydrogen fuel and interest-free financing.[97] These measures underscore Toyota's — and the car industry's — challenges in making the

FCEVs commercially viable. Given these challenges, the focus shifts to the Alternative Fuels Infrastructure Regulation (AFIR) and its potential to address some of these issues.

5.3 The Alternative Fuels Infrastructure Regulation (AFIR) and Its Implications

As part of Fit for 55 package, the European Commission proposed revision of the 2014 Directive on Alternative Fuels Infrastructure and turn it into a regulation, now known as AFIR. Among other initiatives, in the draft regulation, the Commission proposed mandatory targets for electric vehicle charging points and hydrogen refuelling points. Inter-institutional negotiations commenced in November 2022, culminating in a provisional agreement on 28 March 2023. The European Parliament approved the new rules in a plenary session on 11 July and the final act was published in the Official Journal of the EU on 22 September 2023.[98]

Targets and Requirements for EV Charging

For EV charging, Member States are required to ensure that for every registered battery electric light-duty vehicle (LDV), at least 1.3 kW of power is available through publicly accessible recharging stations, and 0.80 kW for each plug-in hybrid LDV. If electric LDVs constitute at least 15% of the total LDV fleet and there's a risk of oversupply discouraging private investment, Member States can request lower requirements. Along the TEN-T core network, recharging pools must be deployed every 60 km in each direction, with a minimum power output of 400 kW by 2025 and 600 kW by 2027, each including at least one 150 kW point. By 2030, the TEN-T comprehensive network must have similar recharging pools covering at least 50% of its length, each offering 300 kW, with all pools achieving 600 kW by 2035. Single recharging pools accessible from both directions are allowed if they meet the power output requirements. Roads with low traffic may have derogations.[99]

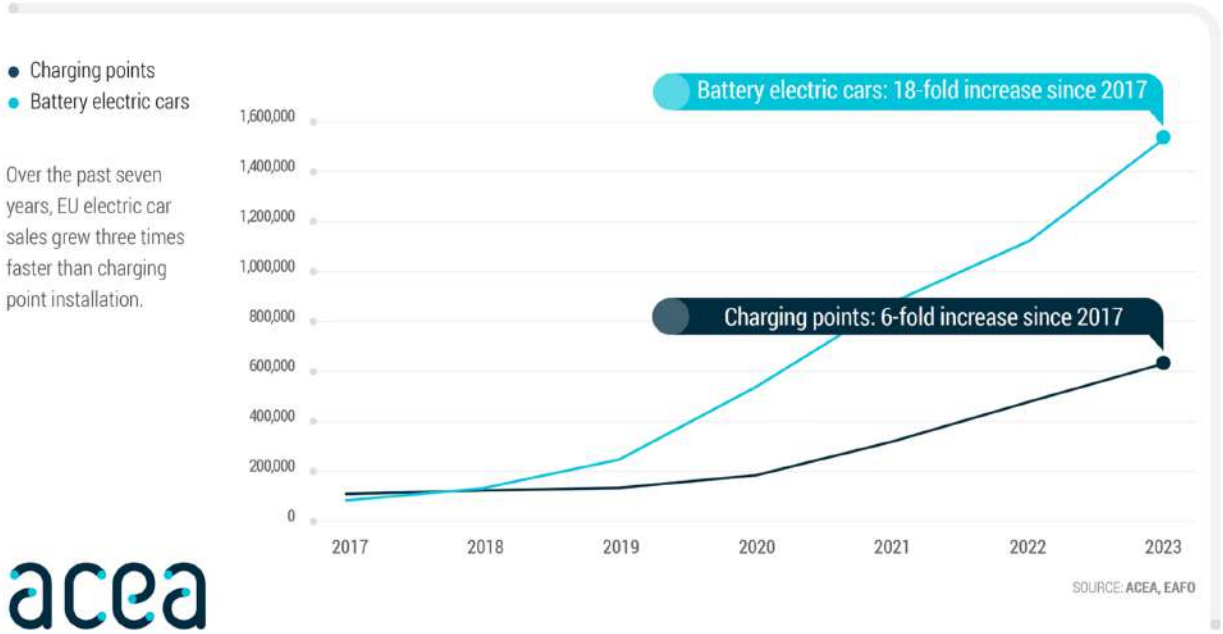
Challenges in Meeting Charging Infrastructure Demands

AFIR is important because it is part of the EU's efforts to enable the EV transition as charging infrastructure remains the sore point. A J.D. Power study revealed that nearly half (49%) of potential vehicle buyers rejected EVs due to concerns about charging infrastructure. The primary issue deterring buyers is the lack of public charging availability, which has not kept pace with the increasing number of EVs.[100] Indeed, the situation is so dire that already existing EV buyers are considering returning to an ICE vehicle as their next car. A recent McKinsey & Co. survey indicates that over 40% o EV owners in the U.S. are considering switching back to combustion engine vehicles for their next purchase. In addition to dissatisfaction with the current EV infrastructure and charging options, the report also highlights that a significant percentage of EV owners find the public charging experience inadequate, which hampers the overall adoption and satisfaction with EVs.[101]

Industry and Legislative Concerns

Despite AFIR's ambition, it may not be enough. ACEA reports a significant shortfall in the EU's public charging infrastructure for EVs, threatening the achievement of CO2 reduction targets by 2030. Between 2017 and 2023, EV sales outpaced the installation of charging points by a factor of three. To meet future needs, the EU must increase the installation rate to 1.2 million chargers per year, eight times the current rate, argues ACEA. The Associated therefore estimates that 8.8 million charging points will be needed by 2030, whereas the European Commission projects 3.5 million. The ACEA emphasises the urgent need for expanded public charging infrastructure and notes that inadequate power grid capabilities remain a critical unresolved issue.[102]

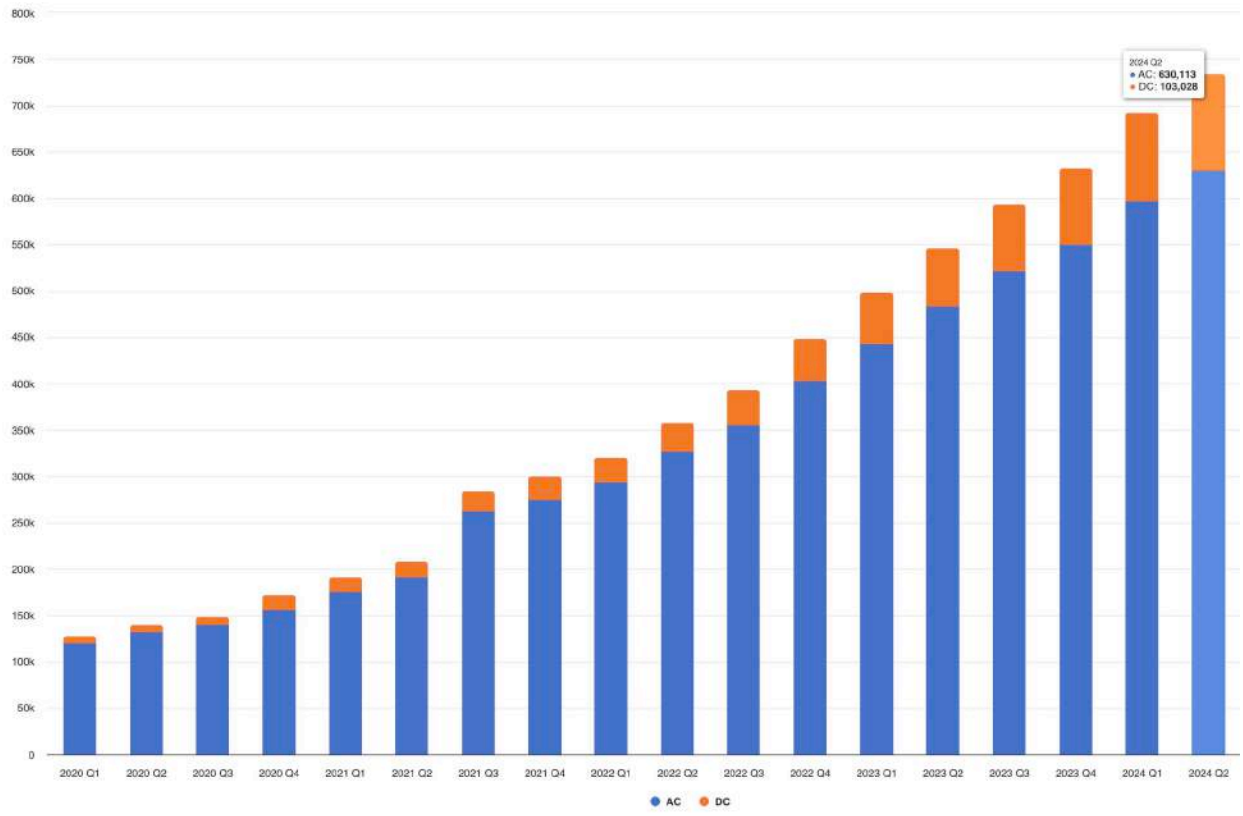
EV Sales Surge Outpacing Charging Infrastructure Deployment in the EU



Source: ACEA

Similarly, the International Road Transport Union (IRU), whilst generally welcoming AFIR, notes that it lacks the ambition and criticises the absence of adequate power grid infrastructure. The Union also notes that more frequent revisions and greater detail in the regulation are necessary to meet industry needs.[103] The Federal Association of Consulting for New Mobility (BBNM e.V.) also raised concerns about the adequacy AFIR which the European Commission must review every five years starting by the end of 2026. BBNM e.V. argues that this review cycle is too slow for the rapidly evolving market and notes the absence of the Megawatt Charging System (MCS) in the regulation. BBNM e.V. also notes the regulation's generalities and omissions, such as protection against fraudulent QR codes.[104]

Only 1 in 7 Public EV Chargers in the EU are DC Fast-Chargers



Source: European Alternative Fuels Observatory

Despite future projections for EV adoption in Europe, current legislation falls short in providing the necessary infrastructure to meet Green Deal objectives. While private initiatives play a crucial role, they tend to focus on commercially viable locations for charging stations. This creates a gap in the comprehensive deployment of charging infrastructure needed for widespread EV adoption. Consequently, there is a clear need for enhanced legislative measures and public investment to ensure the infrastructure meets the demands of the growing EV market across all regions. A report by EY-Parthenon, noting the above-discussed issue of EV charger infrastructure gap, notes the urgent need to drastically increase the annual installation rate of public charging points. The report stresses the importance of collaboration among investors, charge point operators (CPOs), governments, and automotive manufacturers to address this infrastructure shortfall and ensure sustainable EV adoption. Key strategies include optimising charging point locations, enhancing the reliability of the charging network, and integrating renewable energy sources to reduce costs.[105]

The Critical Need for Expanding Fast-Charging Infrastructure

It is also important to note that AFIR does not solve the bigger problem of the lack of overall fast chargers. While it is the case that the number of charging points across

Europe is rising rapidly, the situation is far from perfect. As electric vehicle adoption grows and battery capacities increase, the demand for faster charging solutions becomes more critical. Larger batteries require more energy to charge, making it essential to have fast chargers that can deliver high power output efficiently. Standard AC chargers, with their maximum output of 22 kW to 43 kW, are becoming insufficient for the needs of modern EVs with larger batteries.

To put this into context, a Standard Range Tesla Model 3 has a 60 kWh battery,[106] while the 2023 best-selling EV in Europe, the Tesla Model Y, comes with an 78.1 kWh battery in its Long Range version.[107] EVs with battery sizes exceeding 100 kWh are becoming increasingly common and will likely continue to grow in prevalence. This trend is driven by consumers' desire to alleviate range anxiety and their demand for vehicles with greater range capabilities. As such, it takes around 4 hours to fully recharge the most common EVs.

To accommodate the increasing number of electric vehicles and their evolving requirements, a substantial expansion of the fast-charging network is therefore necessary. Fast chargers, capable of delivering 50 kW to 350 kW, are essential to reduce charging times and improve the overall convenience of electric vehicle ownership. Without a robust network of fast chargers, the adoption of electric vehicles may be hindered, as long charging times at AC stations can be a significant inconvenience.

At the moment, however, only around 1 in 7 chargers installed in Europe are DC fast-chargers. According to European Alternative Fuels Observatory, out of 700,000 public recharging points in Europe, just over 100,000 are DC fast-chargers.[108] It is important to note, however, that not every charger will need to be converted to fast-charging capabilities. Many electric vehicles do not require fast-charging for everyday use; this necessity becomes most relevant during long-distance travel or when drivers are pressed for time. For typical daily commutes and short trips, standard charging is usually sufficient and more cost-effective. Therefore, a balanced infrastructure that includes both fast-charging and standard charging options will still be relevant.

Nevertheless, it is crucial to recognise that charging remains a significant obstacle for both prospective EV buyers and current owners. According to a recent survey by McKinsey, nearly half of EV owners in the United States are considering a return to ICE vehicles, citing high costs and the inconvenience of recharging.[109]

Misalignment of Hydrogen Infrastructure Mandates with Market Demand

In line with AFIR, by December 2030, publicly accessible hydrogen refuelling stations must be deployed along the Trans-European Transport Network (TEN-T) core network, with a maximum distance of 200 km between each station. Additionally, at least one publicly accessible hydrogen refuelling station is required in every urban node of the TEN-T network, aiming to address infrastructure challenges and support the transition towards alternative fuels.[110]

This legislative push for hydrogen infrastructure starkly contrasts with the market's trajectory, demonstrating a significant misalignment between policy and actual

demand. The AFIR's mandates for hydrogen refuelling infrastructure do not reflect the dwindling interest and FCEVs, as discussed earlier. This misalignment not only represents a misallocation of resources but also risks diverting attention and funding from more viable alternative fuel solutions like electric vehicles (EVs), which, despite struggles, have seen a steady increase in demand and market penetration. The persistence of such legislative mandates underscores the need for policy adjustments that better align with technological advancements and consumer preferences, ensuring that infrastructure development is both efficient and reflective of real-world needs.

6 Economic and Regional Challenges in Implementing the Green Deal

This section explores the distinct challenges and opportunities presented to economically vulnerable regions, with a particular focus on smaller Member States and those with constrained financial resources.

6.1 Economic and Regional Disparities in the Green Transition

Central to the opposition to the Green Deal is its exorbitant price tag", which many critics argue outweighs the potential benefits. This financial burden, they contend, could exacerbate national debt and place undue strain on taxpayers. Furthermore, there are significant concerns regarding competitiveness and competition. The stringent regulations and high costs associated with implementing green policies could hinder economic growth, particularly for industries reliant on traditional energy sources. Critics fear that such measures would put domestic businesses at a disadvantage compared to international competitors not bound by similar environmental regulations, potentially leading to job losses and economic stagnation. As Jessica Stegrud, former member of the ECR Group in the European Parliament, observes, "If the Green Deal could single-handedly ensure that no climate change would take place this century, I would support it – even with the hefty price tag. This, however, is not the case", further adding that "The €1 trillion Euro Green Deal is expensive even by EU standards and so requires closer scrutiny and a greater degree of caution."[111]

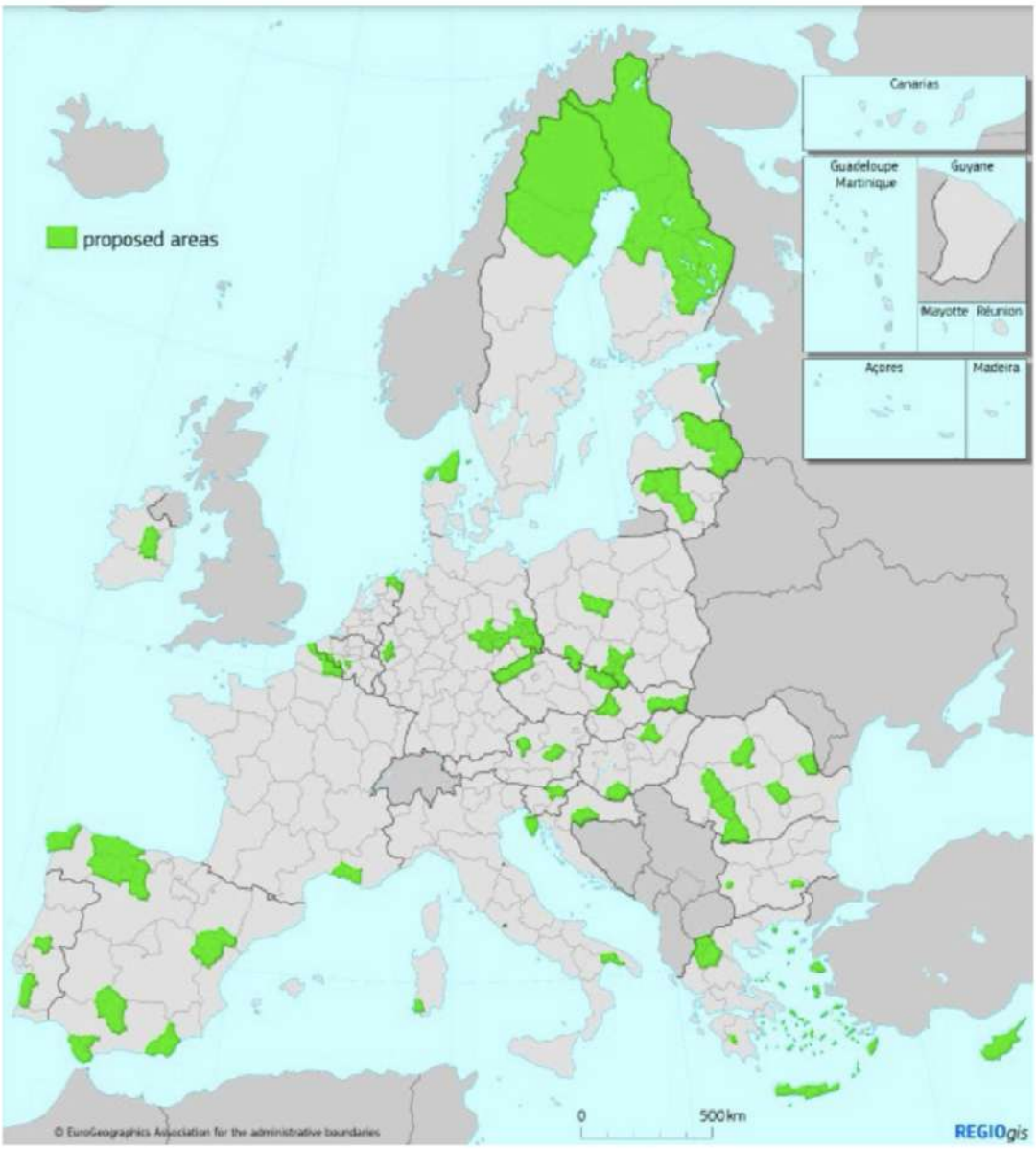
Additionally, the rapid transition to green energy could disrupt existing markets and create monopolistic tendencies, stifling competition and innovation. National climate ambitions are driving a new wave of protectionism, with subsidy-driven policies for renewable technology adoption raising concerns about market distortion. Advanced markets' domestic emissions thresholds disproportionately penalise shipments from developing economies. The commitment to green agendas in regions like the EU suggests limited concessions to international economic partners on environmental issues.[112]

Beyond these — and a number of smaller — arguments lies the regional reality: the stark differences between the Member States. Smaller and less affluent Member States face significant challenges in adjusting to the Green Deal's demands. These nations often lack the financial resources necessary for a swift transition. As a result, they risk being left behind, exacerbating existing economic disparities within the EU.

The uneven distribution of resources and capabilities means that while wealthier Member States may successfully implement and benefit from green policies, their less affluent counterparts could struggle with increased costs and insufficient support. This imbalance threatens the cohesion of the union, creating friction between Member States and undermining the collective effort needed to tackle environmental challenges effectively. As Roberts Zīle, European Parliament's Vice-President, argues, the

ambitious Green Deal objectives must be matched by ambitious funding. Instead, "the European Green Deal is driven by the carrot and stick principle. Unfortunately, the carrot is small, while the stick is large. … the carrot .. is not substantial: just a little over 1% of the EU's GDP. In my view, this carrot-and-stick approach is utterly useless."[113]

Territories Eligible for Just Transition Fund



Source: European Commission, as cited in Widuto, A., & Jourde, P. (2021)

6.2 Just Transition Fund: Challenges and Shortcomings

The idea that the money on the table is not enough to support the Green Deal ambition is warranted. Especially when it comes to regions, which are at greater risk of being left behind. To allegedly tackle this, the European Commission proposed the Just Transition Fund (JTF) on 14 January 2020, as part of the European Green Deal. The JTF targets regions with significant transition challenges, providing grants to alleviate the socio-economic impacts of moving to a low-carbon economy. It will complement existing cohesion policy funds and national co-financing, forming part of a broader Just Transition Mechanism alongside InvestEU resources and a public-sector loan facility.

In response to the coronavirus pandemic, an amended proposal with a budget of EUR 17.5 billion was published on 28 May 2020, with funding sourced from the EU budget and the Next Generation EU instrument. The European Parliament adopted the draft regulation on 18 May 2021, and the final act was published on 30 June 2021. Thus the JTF aims to finance productive investments in SMEs, clean energy infrastructure, digitalisation, land restoration, circular economy initiatives, and social inclusion projects. The fund excludes investments in nuclear power, fossil fuels, and tobacco. Territorial just transition plans, prepared by Member States, will guide the allocation of JTF resources, focusing on regions facing the most significant transition challenges.[114]

However, it is evident that the allocated EUR 17.5 billion is far from sufficient to support the set objectives, considering this amount is intended for a multi-year period. To put this into perspective, the combined GDP of the three Baltic States in 2023 — among the smallest economies in the EU, with around half their territory qualifying for the JTF — alone surpassed EUR 160 billion.[115] As European Trade Union Confederation observed during the announcement of the proposal, “the just transition [funding] does not match the European Commission’s ambition for its green deal. The funding proposed for 10 years is what would be needed every year to achieve climate neutrality by 2050 in a fair way.”[116]

6.3 Regional Vulnerability in the Green Transition

The economic and regional disparities exacerbated by the Green Deal are further highlighted by the findings of academic literature. Rodríguez-Pose and Bartalucci present a detailed analysis of the potential regional impacts of the green transition, finding that Southern and Eastern Europe are particularly exposed to the changes brought about by the green transition.

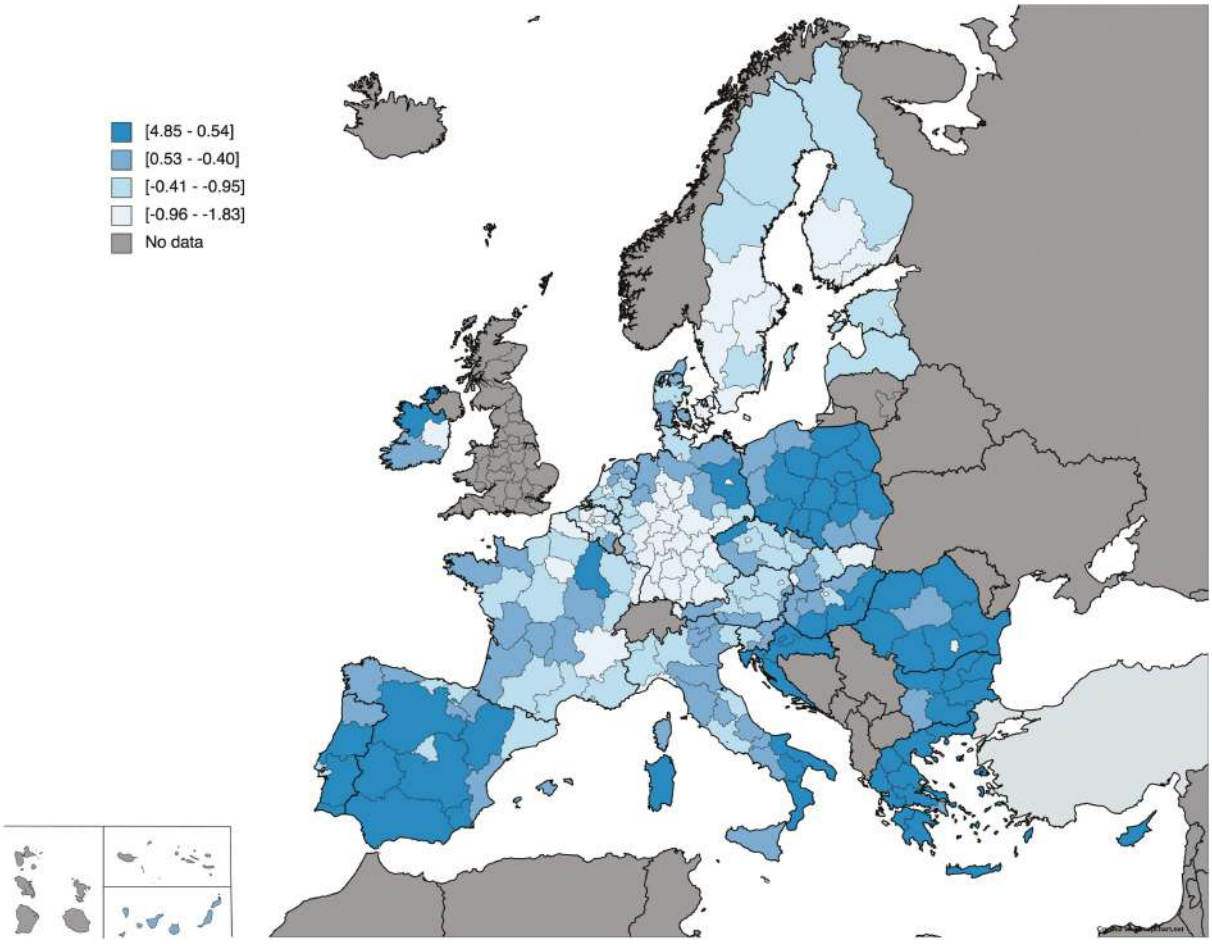
Their Green Transition Vulnerability Index includes six broad pillars: fossil fuel dependency and emissions, industry, agriculture and land use, tourism, energy, and transportation. Each pillar consists of specific metrics such as CO2 emissions per capita, the economic importance of mining and agriculture, tourist arrivals, energy demand for cooling, and dependency on road freight transport. These metrics collectively assess the vulnerability of regions to the socio-economic impacts of the

green transition, highlighting disparities in regional capacities to adapt to low-carbon economies.

The index brings to light strong regional variations in vulnerability across Europe where wealthier regions, particularly metropolitan areas, are less vulnerable due to their superior infrastructure, financial resources, and institutional capacity. Meanwhile less developed, peri-urban, and rural regions in Southern and Eastern Europe are particularly exposed to the changes brought about by the green transition.

Beyond direct job losses in sectors like coal, the green transition is expected to cause significant indirect effects, such as skilled migration from vulnerable regions to more prosperous areas, thereby exacerbating regional inequalities.

Regional Green Transition Vulnerability Index by Subnational Regions (NUTS 2 level)



Source: Rodríguez-Pose, A., & Bartalucci, F, 2024

To mitigate these impacts, Rodríguez-Pose and Bartalucci argue for a more nuanced approach to green policies, emphasising the need for targeted support to ensure a just

transition. Besides calling for the JTF to cover broader indirect impacts, they also advocate for the development of regional-specific strategies that consider local conditions and capabilities and emphasise the need for increased participation of local communities in the planning and implementation of green policies.[117]

6.4 Contextualising Green Transition for Less Affluent Regions: The Case of EVs

The earlier sections have already addressed the high cost of electric cars. However, the absolute number and the averages, while informative, do not account for the varying purchasing power and economic conditions of different Member States and their citizens. The case in Eastern EU Member States is much more stark.

The discussion surrounding the eventual decline in electric vehicle (EV) prices and their increased affordability might hold relevance for more affluent EU Member States and their potential car buyers. However, the situation in Eastern European Member States presents a stark contrast. Examining two countries illustrates the significant disparities.

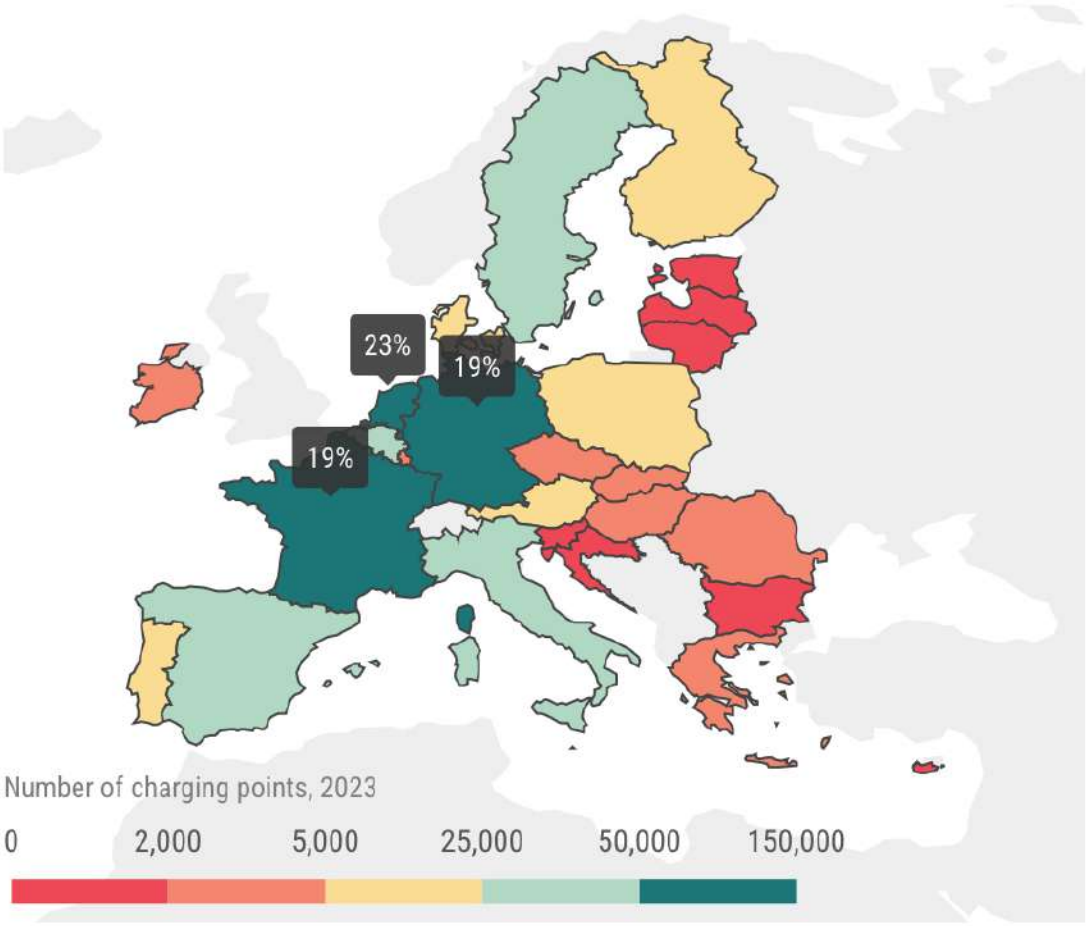
In Germany, the average price for new passenger cars in 2022 was EUR 42,790, while the average price for used cars was EUR 18,800.[118] In stark contrast, Latvia saw an average used car price of just EUR 8,647 in the first nine months of 2022, marking a 28% increase from the previous year.[119] This comparison, however, does not fully capture the economic realities faced by car buyers in Latvia. Data from SEB bank Latvia, which provides insights into car loans, reveals that nearly half (43%) of Latvian car buyers seek loans for vehicles costing no more than EUR 7,000.[120] In 2022, the average age of newly purchased cars in Latvia — whilst falling sharply — was still nearly 8 years.[121]

This stark difference in car affordability between Germany and Latvia underscores the broader economic divide within the European Union and the challenges associated with the Green Deal objectives. While wealthier member states might anticipate the benefits of falling EV prices, these advantages remain largely out of reach for consumers in less affluent regions.

Critics argue that subsidies are necessary, and the EU funds are intended for this purpose. In Latvia, EU funding subsidises new EV purchases with EUR 4,500 for new EVs and EUR 2,250 for used ones. However, the most commonly purchased cars with these subsidies are Teslas and BMWs[122] — brands not typically associated with affordability, especially when compared to the average car purchasing price in Latvia. It is reasonable to assume that most of those who use the EV subsidy could afford the car without it. For the majority of average car buyers, the subsidy does not influence their purchasing decision. This misalignment suggests that subsidies are not effectively lowering the barrier to entry for the majority of the population in less affluent Member States. Instead, they inadvertently reinforce the economic divide by primarily assisting those who are already better off.

The infrastructure gap further complicates the situation. As ACEA report, nearly two-thirds of all EV chargers available in the EU are located in just 3 countries. Germany,

Distribution of EV Chargers in the EU: Over 60% Concentrated in Just Three Member States



Source: ACEA

with its extensive network of EV charging stations, contrasts sharply with countries like Latvia and Lithuania, where charging infrastructure is more sparse and underdeveloped. Germany had over 120,000 public charging points in 2023, while Latvia had just over 500. While critics may argue that the number of chargers should be considered in relation to a country's size and population, ACEA data reveal a stark contrast: the Netherlands, with a population of 17.7 million and roughly half the land area of Latvia, boasts over 144,000 EV chargers.[123] This infrastructural lag not only disincentivises EV purchases but also underscores the uneven playing field created by the Green Deal's one-size-fits-all mandates.

Furthermore, the reliance on EU funding to bridge these gaps is problematic. The allocation and disbursement of EU funds are often subject to bureaucratic delays and inefficiencies, further slowing the transition process in poorer MS. The administrative complexity and the need for co-financing from national budgets, which are already

strained, limit the effectiveness of these funds in making a substantial impact. To mitigate these regional disparities, funding strategies must be carefully evaluated to ensure an equitable transition.

7 Funding the Green Transition: Strategic Investment in the European Union up to 2030 and Beyond

The European Union's ability to meet its long-term objective — primarily managing the climate — and digital — transitions, coupled with self-imposed need for achieving greater economic resilience — will depend crucially on both the amount and the nature of its investments. EU Member States collectively face a total annual investment gap of at least EUR 481 billion up to 2030.[124] Closing this gap is essential for achieving the EU's strategic objectives and will require the efficient use of public resources and the mobilisation of private investment.

What is more, in its 2040 climate policy recommendations, presented in early 2024, the EU executive stated that an annual investment of EUR 1.5 trillion will be required between 2030 and 2050 solely to achieve the EU's decarbonisation targets in the energy and transport sectors.[125]

Experts propose various solutions to bridge the gap. Francesco Findeisen and Sebastian Mack from Jacques Delors Centre advocate for increased public spending to complement InvestEU, emphasising that certain critical projects, especially those involving public infrastructure or non-commercially viable green initiatives, cannot be funded through private investment alone. The authors argue that fresh public spending at the EU level is necessary to finance these transformative investments. The paper also calls for a reduction in InvestEU's leverage ratios. High leverage prevents the programme from taking on the risks necessary to provide substantial additional green investments. By increasing public financial support, InvestEU could better mobilise private investments for high-risk projects with long-term sustainability benefits. Lastly, the paper highlights the need for greater transparency and accountability as current reporting mechanisms do not adequately track the climate and environmental impacts of InvestEU-financed projects.[126]

Elsewhere, Demertzis et al. from Bruegel meticulously define 'strategic investment' within the EU context, proposing conditions under which such investments should be co-financed at the EU level. This co-financing is justified by the potential for EU value addition, notably through cross-border efficiency gains. To help bridge the financing gap, the paper recommends prioritising investments that contribute significantly to the EU's economic and security interests, with specific examples including energy and connectivity infrastructure with cross-border impacts, and innovation-promoting facilities. By reviewing past and present EU strategic project financing programmes, the authors identify a key issue: the lack of continuity in EU investment programmes, which have historically been finite and sporadic with overlapping objectives. To address this, they propose creating a dedicated and permanent fund for European Strategic Investments (ESIs). This fund would initially be sourced from a partially repurposed European budget and managed by the European Investment Bank (EIB). Moreover, the authors stress the need for the EU to establish new own resources to

repay the debt issued under the NextGenerationEU post-pandemic recovery instrument. This would eventually provide additional dedicated financing streams for ESIs, ensuring the continuity of strategic objectives.[127]

7.1 Political Challenges of Funding Solutions

The experts rightly identify the significant funding shortfall for the European Green Deal, noting the EU's reliance on leveraging private investment through InvestEU. However, their critique of InvestEU's high leverage ratios and insufficient public financial support may not fully appreciate the complexities of the EU's budgetary constraints. While increasing public spending is theoretically sound, in practice, it is politically challenging due to divergent fiscal policies among member states and existing EU budget limits. Given the EU's diverse economic conditions and budgetary constraints, securing additional public funds on the required scale is a significant hurdle.

The call to reduce InvestEU's leverage ratios, while seemingly well-intentioned, might undermine the programme's ability to attract substantial private investments. High leverage, while risky, is a mechanism to maximise investment with limited public funds. Reducing leverage without a clear alternative strategy could diminish InvestEU's overall investment capacity.

As regards the call to repurpose the European budget for a dedicated fund could face significant political resistance, particularly from member states with stringent budgetary constraints. Secondly, the reliance on the European Investment Bank (EIB) as the natural manager of the proposed fund, while logical, may overlook potential conflicts of interest and governance challenges within the EIB itself.

More contentious still is the ageing call for own resources for the EU budget. This proposal, while sidelining the federalist spirit at this point, fails to thoroughly examine the potential economic impacts on member states, particularly those with weaker economies. The introduction of new own resources would, at best, merely redistribute existing funds. At worst and most likely, it would exacerbate economic disparities within the Union, reversing the convergence achieved thus far.

7.2 Innovative Investment Strategies and Policy Enhancements for the Green Transition

Private investment, driven by market forces and technological advancements, can significantly contribute to the green transition if adequately incentivised. Rather than solely increasing public spending, the EU could explore more robust mechanisms to de-risk private investments and foster public-private partnerships. By offering guarantees, subsidies, and co-financing options, the EU could potentially create an environment where private capital feels secure and motivated to invest in green technologies and infrastructure. Additionally, regulatory frameworks should be streamlined to facilitate faster project approvals and implementation, thereby attracting more private sector involvement.

Dedicated Financing for Smaller Member States

For smaller member states where private capital is not easily attracted, there needs to be dedicated financing available that exceeds current initiatives like the Just Transition Fund (JTF). Specifically, there should be a green convergence tool designed to provide substantial financial support for these nations. This tool would ensure equitable access to funds necessary for green projects, enabling smaller economies to participate fully in the EU's sustainability goals. It would also help to prevent regional disparities and promote a balanced green transition across the Union.

Innovation and Technological Development Grants

To further bolster strategic investments, the EU could introduce grants specifically aimed at innovation and technological development. These grants would target small and medium-sized enterprises (SMEs) and startups that drive the green and digital transitions. By providing direct financial support, the EU can stimulate high-risk, high-reward projects that private investors might shy away from.

Decentralised Fund Management

A decentralised approach to fund management could be more effective in addressing regional disparities. Establishing regional investment boards composed of local stakeholders and experts can ensure that funds are allocated efficiently and transparently. This method would cater to the unique needs of different regions while maintaining the overarching strategic objectives of the EU.

Less Regulation, More Incentives

As has been discussed earlier, Europe's response to the US Inflation Reduction Act (IRA) has been fragmented and underwhelming. Despite possessing the entrepreneurs and private capital necessary for innovation, Europe lacks favourable public policy to support these ventures. Notably, Europe generates more startups than the US, yet the number of scale-up businesses, particularly unicorns, falls short.[128] This disparity is largely due to easier access to capital in the US, which enables more companies to reach billion-dollar valuations, posing significant challenges for European startups. One part of the solution is the Capital Markets Union, although it is far from a straightforward or quick fix. The opposite is true for reducing red tape. The regulatory environment in Europe, which tends to emphasise penalties over incentives, is a stark contrast to the US's tax credits and climate subsidies. To ensure competitiveness against American companies, the EU must create a more supportive environment for green companies looking to scale up — and for private capital more broadly — thereby fostering a more favourable landscape for business growth.

8 Conclusion

The EU's Green Deal and the green transition more broadly, as examined in this comprehensive study, is a multifaceted endeavour with ambitions that often clash with economic and regional realities. The Green Deal aims to propel Europe towards climate neutrality by 2050, yet the disparity between its objectives and practical implementation remains significant.

The critical evaluation of strategic approaches, including the Green Deal Industrial Plan, highlights substantial gaps in financial and infrastructural support. The comparison with the USA's Inflation Reduction Act underscores the need for the EU to simplify regulations and enhance incentives to foster investment in green technologies. Additionally, China's dominance in clean tech manufacturing poses a strategic challenge that the EU must address through more robust policies and diversified supply chains.

Economic and regional disparities present a major hurdle in the Green transition. Smaller and less affluent Member States face considerable financial constraints, risking further economic inequality within the Union. The Just Transition Fund, while a step in the right direction, is grossly underfunded to meet the extensive needs of these regions.

The automotive sector case study vividly illustrates the challenges of scaling up electric vehicle production and the political and economic complexities of phasing out internal combustion engines by 2035. The affordability and infrastructure for EVs remain critical issues, further complicated by the rising cost of new vehicles and inadequate charging networks. Additionally, the mandate for hydrogen infrastructure, despite low market demand for hydrogen vehicles, reflects a misalignment of policy and market realities.

Funding the Green transition is pivotal. While increasing public spending and leveraging private investment are essential, the strategies proposed must navigate the EU's budgetary constraints and political complexities. Innovative financing mechanisms, robust de-risking of private investments, and targeted support for smaller Member States are crucial for bridging the investment gap and ensuring a balanced transition.

Ultimately, the study calls for a recalibration of the EU's Green transition strategy, emphasising the need for realistic, flexible frameworks that align ambitious climate goals with economic realities. By fostering a more conducive regulatory environment, ensuring equitable regional support, and mobilising both public and private investment effectively, the EU can achieve a just and inclusive transition for all its Member States. The path to pragmatic climate neutrality is undeniably challenging. Now more than ever, a balanced approach that harmonises economic growth with environmental and competitive sustainability, and considers the diverse circumstances of Member States while addressing the interests and concerns of industries and the public, is vital. The delicate balance between aspiration and feasibility within the EU's Green transition framework remains key to achieving prosperity for Member States and the EU alike.

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