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DeCrises

D3.1 EU's Green Transition guidelines and principles

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Key takeaway messages

- This report examines the main EU documents relevant to decarbonisation and achieving the EU's 2050 carbon-neutrality goal.
- Its structure follows the main topics of the European Green Deal, the EU's flagship initiative in decarbonisation. Each section of the report examines the key documents, discusses existing limits and obstacles, and presents the linkage to multilevel governance, which is the main theoretical approach of the DeCrises project.
- Although there are ambitious and clear goals at the EU level that could support the ultimate goal of carbon neutrality by 2050, it is the member states that must follow these principles and deliver greenhouse gas reductions. There are significant differences among member states in this regard, and not all fully support the decarbonisation goal in practice.
- The report identifies numerous obstacles and barriers that the EU must overcome to decarbonise all sectors of its economy. This is manageable; however, support from actors at various levels is necessary in this process.
- Multilevel governance is a suitable approach for examining issues related to decarbonisation, as it allows us to identify bottlenecks in collaboration across various levels of governance and the various weak points in the 'chain of command'.
- The regional, local, and municipal levels are crucial for implementing the EU's decarbonisation policies. It is at these levels that significant reductions in greenhouse gas emissions can be achieved.
- By examining these issues, this report lays the foundation for further examination of the just twin transition within the European Union.

Executive summary

This report evaluates the European Union (EU)'s strategic framework for the 'green' dimension of the twin just transition, focusing on its strengths, limitations, and alignment with a multilevel governance (MLG) approach. It reviews six key areas derived from the European Green Deal (EGD) and related policy documents that guide the EU's pathway toward climate neutrality by 2050. Each thematic section analyses core strategies, identifies structural and political barriers, and assesses implementation through an MLG lens.

First, the report highlights tensions within the EU's energy security agenda. While long-term decarbonisation supports energy security, short-term crisis responses – such as emergency fossil fuel measures – can undermine these goals. Additionally, the relationship between the green and digital transitions is not fully synergistic. Digitalisation increases energy demand and introduces new systemic risks, raising concerns about whether it can deliver a socially just and sustainable energy system under current market conditions.

Second, the EU's vision of a clean and sustainable economy is recognised as ambitious and comprehensive, integrating climate neutrality, circular economy principles, and social equity. However, progress is constrained by persistent challenges, including investment shortfalls, fragmented governance structures, socio-political resistance, and external dependencies. The report emphasises that success will depend less on new targets and more on improved coordination across governance levels, stronger procedural legitimacy, and context-sensitive regional implementation.

Third, in the field of sustainable and smart mobility, the EU's limited executive authority poses challenges. As transport policy largely remains under member state control, conflicting national interests hinder cohesive implementation. Funding mechanisms often continue to prioritise road infrastructure, reinforcing car-dependent systems rather than enabling transformative change. Public acceptance also remains a barrier, particularly regarding urban mobility measures such as cycling infrastructure.

Fourth, the research and innovation sector is identified as critical but underperforming relative to EU ambitions. Despite substantial funding and strategic frameworks, the EU struggles to attract global talent and facilitate intra-EU mobility. Fragmentation in higher education systems creates additional barriers. Strengthening innovation capacity – particularly in low-carbon technologies – requires removing these obstacles and increasing support not only for technical fields but also for social sciences and humanities, which are essential for addressing public resistance and behavioural aspects of the transition.

Fifth, the EU's aspiration to lead globally on climate and energy is closely tied to the effectiveness of its governance. Although the EU has developed extensive policy tools and external strategies, inconsistencies between EU-level objectives and national implementation weaken its international credibility. Greater inclusion of subnational actors – such as cities and regions – is necessary, as they play a central role in delivering climate action but remain underrepresented in strategic planning.

Finally, the report underscores that while the EGD constitutes one of the most comprehensive climate policy frameworks globally, significant gaps persist between ambition and implementation. Challenges span financing, governance coordination, technological deployment, social equity, and long-term planning. Bridging these gaps is essential to achieving the EU's 2050 climate neutrality target. Overall, the report concludes that the effectiveness of the EU's green transition will depend on its ability to enhance MLG coordination, align short-term actions with long-term objectives, and ensure inclusive, regionally adapted implementation.



Non-technical summary

This report maps the development of the green transition within the EU, linked to the European Green Deal (EGD) – a document that outlined a plan to decarbonise the EU by 2050. The EU set a goal of developing a carbon-neutral economy by that year, meaning that the economies of member states will not produce more greenhouse gases than they can absorb (especially through natural processes, such as forests). This is a very complex process, and the EGD outlines a set of ideas for achieving this goal. The present report examines these ideas and tools that the EU has developed since the adoption of the EGD in 2019. The report is divided into several sections that reflect the EGD initiative's internal structure. Each section examines not only the EGD as such but also uses it as a springboard for a broader discussion of the development of decarbonisation across the EU economy.

After the introduction, the second section discusses energy security issues related to the EU's decarbonisation efforts, as presented in the EGD and other strategic documents. The third section examines decarbonisation of the EU's economy, while the fourth studies issues linked to sustainable mobility that will contribute to decarbonisation of the EU by 2050. The fifth section presents an overview of decarbonisation policies connected to research and innovation. The sixth part of the report examines the EU as the global leader in decarbonisation, a forerunner of green technologies, and an exporter to international markets. The next-to-last section, number seven, provides a broader view of the climate goals at the heart of decarbonisation efforts. The very last section presents a summary of the findings and offers policy recommendations.

List of abbreviations

CAP – Common Agricultural Policy
CBAM – Carbon Border Adjustment Mechanism
CCS – Carbon Capture and Storage
CCU – Carbon Capture and Use
CEAP – Circular Economy Action Plan
COP – Conference of the Parties
CTIP – Clean Trade and Investment Partnerships
DPP – Digital Product Passports
EGD – European Green Deal
ERC – European Research Council
ESABCC – European Scientific Advisory Board on Climate Change
ESPR – Eco-design for Sustainable Products Regulation
ESR – Effort Sharing Regulation
ETS – Emission Trading System
EU – European Union
G7 – Group of Seven: Canada, France, Germany, Italy, Japan, United Kingdom, United States
G20 – Group of the 20 biggest economies of the world
GHG – Greenhouse Gases
IEA – International Energy Agency
IED – Industrial Emissions Directive
IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC – Intergovernmental Panel on Climate Change
IRENA – International Renewable Energy Agency
JTF – Just Transition Fund
JTM – Just Transition Mechanism
LTS – Long-term Strategies
MaaS – Mobility as a Service
MCA – Multiple Criteria Approach
MCED – Multilevel Climate and Energy Dialogues
NDC – Nationally Determined Contribution
MLG – Multilevel Governance
NECP – National Energy and Climate Plan
NZIA – Net-Zero Industry Act
PCI – Project of Common Interest
RRF – Recovery and Resilience Facility
SCF – Social Climate Fund
SEA – Single European Act
SFDR – Sustainable Finance Disclosure Regulation
TEN-E – Trans-European Networks for Energy
TEN-T – Trans-European Transport Network
UN – United Nations
UNFCCC – United Nations Framework Convention on Climate Change
WP3 – Work Package 3

1. Introduction

The DeCrises project addresses the governance challenges of the European Union (EU)'s twin just transition, supporting the transformation of European society, economy, and infrastructure towards greater sustainability and resilience. Embedded in the framework of multi-level governance (MLG), the project aims to study these two transitions (green and digital) and their interconnectedness through four case studies in the Baltic Sea region that represent various levels of governance . In this way, the project aims to improve our understanding of these crucial transition processes in the context of the ongoing 'polycrisis'[1] and how they can help the EU (and other parts of the world) overcome the consequences of crises such as the Covid-19 pandemic, the Russian invasion of Ukraine, or the one linked to the US-Israeli attack on Iran. Thanks to the MLG approach, we can study these processes at various levels, how they are interwoven, and how they contribute to the overall goal of achieving carbon neutrality by 2050[2] .

The project is divided into several work packages; this report is part of Work Package 3 (WP3), which examines the current state of the just twin transition in relation to the EU's main strategic documents in this area: the European Green Deal (EGD) and a series of documents creating the Digital Strategy. To deliver a compelling assessment of the impacts and effectiveness of implementing these two strategic sets of documents, WP3 examines the content of public documents developed within the EU. In the later stages, the DeCrises project contrasts the findings from this WP with national and local implementation policies at various government levels. The examination within WP3 focuses on the most critical challenges in these policies, addressing questions of policy ownership, data security, and deliberative processes within the EU. To achieve these goals, WP3 is divided into five tasks; this report focuses on the first task (Task 3.1) and serves as its first deliverable (Deliverable 3.1).

This report examines the green dimension of the twin just transition in the EU's strategic documents, thus providing a mapping of strategic thinking within the EU on this issue. It examines not only the main document (EGD)[3], but also the related documents – among others, Communication Towards a green, digital and resilient economy: Our European Growth Model; documents related to the Fit for 55 initiative, the Carbon Border Adjustment Mechanism, energy efficiency directive revision, circular economy idea, and many others to systematise the main guidelines and principles derived from them. The documents are analysed through the lens of critical contemporary academic literature on the green transition and energy systems, and within the theoretical framework of MLG traced in WP1. This report thus provides a systematic and integrated characterisation of the main EU guidelines for the green transition, specifically the energy transition, highlighting their strengths and limitations. Special attention is paid to guidelines related to MLG.

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[1] See, for example: Lawrence, M., Homer-Dixon, T., Janzwood, S., et al. (2024). Global polycrisis: the causal mechanisms of crisis entanglement. Global Sustainability 7, 6, doi:10.1017/sus.2024.1.

[2] European Council. (2019). European Council meeting (12 December 2019) – Conclusions. https://data.consilium.europa.eu/doc/document/ST-29-2019-INIT/en/pdf.

[3] European Commission. (2019). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and The Committee of the Regions. The European Green Deal. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640

1.1 Background

The development of energy policy at the EU began at the end of the 1980s, when the energy market became part of a broader internal market development[4]. The 1985 Delors Commission began the process of finalising the internal market, and the Single European Act (SEA) provided the decisive push. The 1990s and 2000s saw a significant development of the EU's internal energy market, as three liberalisation packages were adopted in the electricity and natural gas sectors[5]. This created an energy market that was liberalised almost to the level the Commission envisioned at the beginning of the process (i.e., fully with a strong customer position); however, member states did not cede all their competences to the EU level. Indeed, when the Lisbon Treaty was negotiated in 2007-2008, several important aspects of energy policy – including energy mix structure – stayed in the hands of member states[6]. The Treaty remains in force, as the latest revision of the 'founding' treaties of the EU (the Treaty on the European Union and the Treaty on the Functioning of the European Union), and its Article 194 governs the EU's energy policy.

During the 2009 gas crisis, only some member states highlighted the need to address energy security at the EU level[7]. Several member states were significantly affected, with Bulgaria and Slovakia lacking access to alternative supply routes and thus being without natural gas during the peak of a particularly harsh winter[8]. The existing gas infrastructure within the EU did not allow for the transit of gas to the affected countries; therefore, the need to further develop energy infrastructure within the EU was the main lesson from the event. The Commission saw the crisis as a wake-up call to improve the EU's energy security and proposed a series of tools, including financial ones, to diversify the sources and routes of energy supply to the EU (the Projects of Common Interest)[9]. Therefore, when another crisis was expected during the 2014/2015 winter, following the Russian annexation of Crimea, the EU was prepared (although the crisis did not happen[10]). At that time, the EU had already begun to focus on energy security issues through the Energy Union. This was envisioned by the President of the Commission, Donald Tusk, right after the Russian invasion of Crimea, even before he took office. His proposal for a united EU free from Russian energy meddling was then developed into a broad policy in February 2015[11].

The EU thus started to focus on energy security. This, however, was time for preparation for the 2015 Paris Conference of the Parties (COP 21) under the United Nations Framework Convention on Climate Change (UNFCCC). This led to the Paris Agreement, adopted in December 2015 and entered into force in November 2016[12]. The EU was one of the most prominent supporters of the agreement. The EU had already adopted the 2020 and 2030 climate and energy goals (agreed upon in 2008 and 2014, respectively) and was already discussing even more ambitious goals. Already in 2011, the Commission proposed 2050 as the deadline for developing a carbon-neutral

[4] Primova, R. (2015). The EU Internal Energy Market and Decarbonization. In Dupont, C. and Oberthür, S. (Eds.), Decarbonization in the European Union: Internal Policies and External Strategies (pp. 25-45). Palgrave Macmillan.
[5] Kustova, I. (2017). Unpacking the nexus between market liberalisation and desecuritisation in energy. In Szulecki, K. (Ed.), Energy Security in Europe: Divergent Perceptions and Policy Challenges (pp. 203-220). Springer International Publishing.
[6] Maltby, T. & Mišík, M. (2024). Energy Transitions in Central and Eastern Europe: The Political Economy of Climate and Energy Policy. Cambridge University Press.
[7] Maltby, T. (2013). European Union energy policy integration: A case of European Commission policy entrepreneurship and increasing supranationalism. Energy Policy, 55, 435-444, https://doi.org/10.1016/j.enpol.2012.12.031.
[8] Maltby, T. & Mišík, M. (2024).
[9] European Commission. (2009). The January 2009 Gas Supply Disruption to the EU: An Assessment. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009SC0977.
[10] Stulberg, A. N. (2015). Out of gas? Russia, Ukraine, Europe, and the changing geopolitics of natural gas. Problems of Post-Communism 62, 112–130. https://doi.org/10.1080/10758216.2015.1010914
[11] European Commission. (2025). Energy Union. Energy. https://energy.ec.europa.eu/strategy/energy-union_en
[12] UNFCC. (2025). The Paris Agreement. United Nations Climate Change. https://unfccc.int/process-and-meetings/the-paris-agreement



economy[13]. This goal was reaffirmed in 2018 in "A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy[14]". In 2019, member states agreed on this goal, although it took two European Councils (June and December) to reach common ground. In December 2019, the Commission proposed the EGD[15]. It reflects on the changed priorities as "[in] 2019, the drive for additional EU policies primarily came from the climate threat"[16].

1.2 European Green Deal and the crises

The EGD presents a plan to "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy" that will not emit more carbon emissions than it can absorb, i.e., will be carbon-neutral[17]. The EGD presents a complex document that outlines concrete steps in many aspects of the economy and, together with other related documents, proposes how these can be achieved. The EGD argues that decarbonisation and modernisation are essential if the EU wants to develop a sustainable economy, which is also in line with the EU commitments within the UN. It also claims that international cooperation is crucial for achieving its goals as "the drivers of climate change and biodiversity loss are global and are not limited by national borders"[18].

Already the 2019 December European Council "took note" of the EGD and asked the Commission to "take work forward" as "it recognise[d] the need to put in place an enabling framework that benefits all Member States and encompasses adequate instruments, incentives, support and investments to ensure a cost-effective, just, as well as socially balanced and fair transition, taking into account different national circumstances in terms of starting points"[19]. The Council of the EU, in its various formations, continued working on the initiative throughout the early part of 2020, when the EU, as well as the rest of the world, was hit by the COVID-19 pandemic. The Commission presented its plans for a European Climate Law and a Just Transition Mechanism in March 2020. In June 2020, EU energy ministers discussed how EGD and related issues can support the economic recovery after the pandemic.

While the discussion around EGD, as well as the Commission's position, centred on renewable energy sources, an opposite development occurred in some EU member states. It has been argued that domestic fossil fuels, including coal, should be the basis of post-pandemic recovery because they would prevent price hikes driven by increased demand. Such an argument was also later repeated in connection with the Russian invasion of Ukraine that started in February 2022[20]. However, the majority of member states, as well as the Commission, proposed a 'green' way out of the pandemic – investments in decarbonisation efforts that will help not only restart the EU economy negatively impacted by the pandemic, but also create a long-term advantage for the EU's global position in a post-fossil future. Environmental ministers agreed in June 2020 that "the

[13] European Commission. (2025). 2050 long-term strategy. Energy, Climate change, Environment. https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en

[14] European Commission. (2018). A Clean Planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773

[15] European Commission. (2018). The European Green Deal. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640

[16] Defard, C. (2023). Energy Union 2.0. to deliver the European Green Deal. Jacques Delors Institute. https://institutdelors.eu/content/uploads/2025/04/R127-Energy_Union_2.0_European_Green_Deal_EN-1.pdf.

[17] European Commission. (2019). The European Green Deal, p. 2.

[18] Ibid.

[19] European Council. (2019). European Council meeting

[20] Mišík, M. (2022). The EU needs to improve its external energy security. Energy policy, 165, 112930. https://doi.org/10.1016/j.enpol.2022.112930



European Green Deal should guide the recovery towards green growth and a more resilient EU"[21]. Following this development, EU member states began discussing concrete policy proposals stemming from the EGD (for example, the EU climate law, Fit for 55 and the Just Transition Fund) which will be discussed in individual sections of this report.

1.3 Methodology

The main aim of this report is to provide an overview of the EU's green transition from the perspective of the main strategic documents, identify limitations of this process, and develop an empirical link to the theoretical multilevel governance discussion from working package 1 of the DeCrises project. In order to achieve this goal and produce a comprehensive mapping and analysis of the green transition within the EU, this report employs a complex methodology. The project is based on a critical examination of key strategic documents, as well as other primary and secondary data, utilises qualitative methods to analyse the collected data, and structurally reflects on the project's main theoretical framework. Temporally, the report covers the period between 2019, when the European Green Deal was adopted, and mid-2026, when this report was finalised.

This report is the result of desk research during which the project team analysed several types of primary and secondary data. First, it examined existing official documents published by the EU and its institutions (especially the European Commission) regarding the green transition. These documents are not always primarily focused on the green transition; their key interest might lie elsewhere; however, they have a strong decarbonisation dimension that is of interest to this report. This text identifies the documents' main arguments regarding the green transition, examines the impact of the suggested policies on the process, discusses limitations and obstacles, and offers a linkage to the MLG framework. Second, the report also utilises other types of primary data (especially official statistics) produced by the EU and other institutions, collected during desk research. Third, the report uses academic literature (secondary data) to support its argument and discuss its findings in relation to its own findings.

Primary types of data (i.e., documents and statistics) were collected systematically and chronologically. Therefore, they represent the most important development in EU energy policy connected to decarbonisation since 2019. The authors of this report examined these data (various official documents, primary data) from the perspective of the EU green transition, which we define as a transition in energy policy from fossil-based energy sources (i.e. coal, natural gas, oil) towards renewable (for instance, wind and solar energy) and other low-carbon energy sources (nuclear energy, that is, however, not considered by all member states to be a feasible approach). The main aim of the green economy is to decarbonise the EU's energy system and, in turn, its economy. All collected data were analysed qualitatively (qualitative thematic analysis) in connection to particular issues covered by the report.

The structure of the report reflects the main issues related to the EU's green transition, as outlined in the European Green Deal's main strategic document (see the following section of this introduction for a detailed description of each issue). Each of the report's sections follows the same internal structure, in which the first part provides a descriptive introduction to the main documents that address the particular policy area (for example, energy security). The role of this

[21] European Council. (2020, June 20). Video conference of environment ministers. European Council. https://www.consilium.europa.eu/en/meetings/env/2020/06/23/



part is to analyse the current situation of green transition in connection to the particular issue and offer a strong footing for the following analysis. The second part of each section discusses obstacles and limitations that the policy faces in a given sub-area of energy transition. This part examines the major challenges of the green transition across various areas of energy policy and thus contributes to the discussion of the EU's ability to reach its decarbonisation goals.

The third part of each section then links the findings of the previous two parts with the theoretical model of the whole project – MLG approach. Green transition happens at multiple levels of governance, and the third part of each section discusses various levels at which this transition happens (for example, how climate issues are governed at various levels within the EU) and what the challenges connected to these are (for example, obstacles to clean transit at the municipality level).

1.4 Structure of the report

This report is structured as follows. Reflecting on the structure of the EGD document, after this introduction, the second section examines the EU's strategic thinking on energy security following its adoption, in the context of the COVID-19 pandemic and the Russian invasion of Ukraine. The third section examines strategic documents related to a clean and sustainable economy that emerged in response to the EU's need to merge both competitive and ‘green’ aspects of its future economy. The fourth section discusses sustainable and smart mobility, which is an important part of the decarbonisation process and also supports a socially just transition from fossil to renewable energy sources. The fifth section presents the research and innovation dimension of the EGD and the subsequent development associated with this strategic document.

The sixth section analyses the EU’s role as a global actor through the prism of strategic documents, as this dimension is important for securing global cooperation on green transition and preventing the negative consequences of decarbonisation, such as carbon leakage. The seventh section discusses climate issues within the EGD and the documents and legislation connected to it. Climate and energy issues became closely interwoven at the EU level, given the energy sector's major share of greenhouse gas emissions (GHG) that impact the climate. The last section of the report summarizes the main findings, offers policy implications, and proposes policy recommendations.

2. Secure energy

Energy security has been a central concern in EU energy governance, traditionally defined as the ability to ensure stable, uninterrupted access to energy services at affordable prices. It is widely understood as a multidimensional concept that encompasses not only the security of supply but also affordability, sustainability, and the resilience of energy infrastructure and institutions[22]. In the EU context, these concerns have been shaped by structural dependence on imported fossil fuels and by recurrent geopolitical disruptions, which progressively politicised external energy relations and elevated the strategic salience of vulnerability and dependency.

From the mid-2010s onwards, EU policy increasingly sought to address energy security through deeper market integration and cross-border interconnections, as captured in the Energy Union, which explicitly linked secure, sustainable, and affordable energy to continental-scale system coordination and solidarity[23]. With the launch of the EGD, this approach evolved further: decarbonisation and the reduction of fossil-fuel dependence are reframed not merely as climate policy goals but as structural pathways to a more secure and resilient energy system[24]. This redefinition was accelerated by the geopolitical shock of Russia's full-scale invasion of Ukraine, which brought security of supply and strategic autonomy to the centre of EU policy, most explicitly through REPowerEU's objective of rapidly reducing dependence on Russian fossil fuels while speeding up the green transition[25].

2.1 Key Strategic Documents and Core Legislative Guidelines

The EGD sets out a coherent, interlinked set of orientations that together redefine the meaning of secure energy within the EU. Rather than presenting security of supply and decarbonisation as sequential or potentially competing objectives, it explicitly integrates them into a single structural strategy. The traditional logic, whereby fossil fuels temporarily guarantee stability while decarbonisation is gradually pursued, is replaced by a systemic argument: deeper decarbonisation is itself the most robust pathway to long-term energy security. A power sector based largely on renewable sources, combined with the rapid phase-out of coal and the progressive decarbonisation of gas, is presented as both a climate imperative and a security strategy reducing external dependencies.

Moreover, the principle of 'energy efficiency first' signals that reducing consumption is not a secondary complement to supply expansion but a central pillar of system resilience. By lowering overall energy demand, efficiency measures reduce emissions while simultaneously decreasing import needs and infrastructure pressures. Security is therefore conceptualised not only as ensuring access to sufficient supply, but as transforming the scale and structure of demand itself. The EGD also embeds security within the logic of integration and coordination across member states. The vision of a fully integrated, interconnected, and digitalised European energy market suggests that resilience emerges from interdependence rather than isolation. Cross-border interconnections and regional cooperation are expected to smooth local shocks and balance variable renewable production across territories, thereby mitigating volatility and enhancing

[22] Cherp, A., & Jewell, J. (2014). The concept of energy security: Beyond the four As. Energy Policy, 75, 415–421. https://doi.org/10.1016/j.enpol.2014.09.005; Sovacool, B. K., & Mukherjee, I. (2011). Conceptualizing and measuring energy security: A synthesized approach. Energy, PRES 2010, 36, 8, 5343–5355. https://doi.org/10.1016/j.energy.2011.06.043

[23] European Commission. (2015). A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex: 52015DC0080

[24] European Commission. (2019). The European Green Deal.

[25] European Commission. (2022). REPowerEU Plan (COM(2022) 230 final), https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A52022DC0230&utm_source=chatgpt.com

collective stability. Digitalisation plays a crucial enabling role in this architecture. Smart grids and metering and system integration technologies are framed as tools for optimisation, flexibility and real-time coordination within increasingly complex and decentralised systems.

The concept of secure energy extends beyond technical and infrastructural considerations to include social dimensions. Energy transition is expected to "involve and benefit consumers", and the risk of energy poverty is recognised as a structural challenge that must be addressed through national renovation programmes and targeted support measures. Affordability and social inclusion are incorporated into the definition of security itself, which encompasses households' capacity to access essential energy services under fair and sustainable conditions.

Infrastructure planning further reflects this integrated understanding. The review of the TEN-E Regulation and the prioritisation of smart grids, hydrogen networks, storage technologies, and upgraded assets indicate that long-term security depends on anticipatory investment aligned with climate neutrality. Cross-border cooperation is emphasised not merely for efficiency gains, but as a structural condition for achieving resilience at lower collective cost. The EGD thus does not treat secure energy as an isolated policy objective. Instead, decarbonisation, demand reduction, integration, digitalisation, and social inclusion form mutually reinforcing dimensions of energy security. Security is embedded within the broader transformation of the energy system, rather than conceived as a stabilising add-on to an otherwise unchanged fossil-based model.

The 2022 Communication "Towards a green, digital and resilient economy: Our European Growth Model" [26] revisits the EGD in a radically altered context: post-COVID recovery and the full-scale Russian invasion of Ukraine. This document moves energy security from an implicit co-benefit of decarbonisation to an explicit driver of EU economic policy. The pandemic and the war have revealed "vulnerabilities, including in the energy sector", and the need to strengthen the resilience of the EU economy and its "strategic capacities, such as in energy". Energy security is a key dimension of "open strategic autonomy". The EU seeks to remain open and integrated in global markets while reducing dependencies in critical sectors.

The green transition will reduce energy bills and dependence on fossil fuel imports, improving energy and resource security. Rising prices and geopolitical risks are used to justify faster deployment of renewables and efficiency measures, so that security and decarbonisation agendas are discursively fused. The Growth Model Communication also quantifies the investment needs. It estimates that annual additional investments of around €520 billion are required in 2021–2030, compared with the previous decade, of which roughly €390 billion concerns decarbonisation of the economy and "in particular the energy sector", including buildings and transport. The document specifies that investments are needed in:

- Supply-side infrastructure: renewable energy capacity, storage, upgraded power grids, gas and electricity interconnections, and new fuels (e.g., synthetic fuels).
- Demand-side measures: energy renovation of buildings, industrial decarbonisation, and transport-related infrastructure (recharging and refuelling stations).

The Communication thus operationalises the EGD's vision of secure energy through an investment-centred narrative, positioning public and private capital, the Recovery and Resilience Facility (RRF), and EU funds as key instruments. However, the green transition must "put people first" and protect those most affected by structural change, including via guidance on a fair

[26] European Commission. (2022). Towards a green, digital and resilient economy: Our European Growth Model (COM(2022) 83 final). Brussels: European Commission, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1467



transition and attention to skills and labour-market impacts. This reinforces the EGD's concern for energy poverty and the distributional effects of higher prices and investment costs.

The Factsheet: Towards a green, digital and resilient economy – Our European Growth Model[27] states that the EGD "puts Europe on a new path of sustainable and inclusive growth" and highlights that the green transition will help reduce energy bills and dependence on fossil fuel imports, thereby improving energy and resource security for the Union. The factsheet emphasises three mutually reinforcing priorities:

- Delivering on the Green Deal.
- Seizing the digital decade.
- Enhancing resilience and crisis preparedness.

In each, coordinated investments and reforms "at all levels" (EU, member states, private sector) are presented as necessary.

Since the launch of the EGD in 2019, the EU's approach to securing energy has evolved significantly. What was initially framed as a long-term transformation strategy centred on climate neutrality has increasingly been reshaped by successive crises, most notably the COVID-19 pandemic and the geopolitical shock triggered by Russia's invasion of Ukraine[28]. Energy security has moved from an implicit co-benefit of decarbonisation to a central, explicit policy driver. Energy security is framed as a core dimension of economic resilience and "open strategic autonomy", linking reduced external dependencies to accelerated deployment of renewables and energy efficiency[29]. Measures originally justified primarily on climate grounds — such as electrification, system flexibility, and efficiency — are now equally justified on security and resilience grounds[30]. This crisis-driven reframing has strengthened political consensus around the clean energy transition, but it has also prioritised speed and scale of implementation, potentially at the expense of longer-term governance, regulatory, and institutional considerations.

2.2 Obstacles and Limitations

Despite its internal coherence, the EU's secure energy agenda contains several tensions. While crises have accelerated decarbonisation efforts, they have also led to transitional or emergency measures that may temporarily conflict with longer-term climate objectives[31]. Moreover, the strong emphasis on rapid infrastructure deployment and investment risks underplays questions of regulatory capacity, institutional oversight, and governance of increasingly digitalised energy systems[32]. Digitalisation is often framed as a technical solution, even though it carries significant implications for data management, accountability, and market power.

The way the EGD and the Growth Model communication link secure energy to the twin green–digital transition assumes that digitalisation will deliver efficiency gains, flexibility, and better

[27] European Commission - Press Release. (2022). Towards a green, digital and resilient economy: Our European Growth Model [Factsheet]. Brussels: European Commission. (pp. 1-2). https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_22_1467/IP_22_1467_EN.pdf.
[28] European Commission (2019). The European Green Deal; Rabbi, M. F., Popp, J., Máté, D., & Kovács, S. (2022). Energy Security and Energy Transition to Achieve Carbon Neutrality. Energies, 15(21), 8126. https://doi.org/10.3390/en15218126;
[29] European Commission. (2022). Towards a green, digital and resilient economy: Our European Growth Model.
[30] European Commission. (2022). REPowerEU
[31] European Commission. (2022). Towards a green, digital and resilient economy: Our European Growth Model.
[32] European Commission. (2019). The European Green Deal; European Commission. (2022). REPowerEU.



outcomes for consumers in energy systems[33]. Yet, from a political economy perspective[34], this optimistic narrative is highly partial. Digitalisation generates new energy demand, systemic vulnerabilities, and further concentration of control, with efficiency benefits often accruing to a narrow set of privileged actors rather than the public at large. This raises doubts whether digitalisation can deliver the socially just and ecologically sustainable secure-energy system that EU policy documents promise (see also Deliverable 3.2 of the DeCrises project).

The documents' emphasis on secure, affordable energy via digitalisation and system integration thus appears to downplay some contradictions. First, digital solutions sometimes reduce unit energy use but increase overall consumption[35]. Second, the material and extractive basis of both renewable and digital infrastructures, including critical minerals[36], and, third, the ways geopolitical competition and private profit imperatives shape the direction and pace of low-carbon transitions[37]. While affordability and energy poverty are acknowledged, responsibility for implementation largely remains at the member state level, leading to heterogeneous policy responses and potentially uneven social outcomes across the Union[38].

Taken together, these limits suggest that the EU's secure energy agenda is less a neutral roadmap than a contested political project whose outcomes remain uncertain. The coexistence of long-term decarbonisation goals with short-term crisis responses, the reliance on digitalisation as a largely unproblematised solution, and the delegation of key distributional questions to member states all create space for new inequalities, dependencies, and vulnerabilities to emerge alongside genuine gains in security. Recognising these tensions does not invalidate the ambition of the EGD and the Growth Model, but it does underline the need for more explicit attention to governance, power relations, and social justice if secure energy is to be realised in a substantively equitable and sustainable way.

Precisely because it brings climate, security, and social objectives into a single policy frame, EU energy security agenda offers a more comprehensive basis for mobilising political support around structural change than earlier, more narrowly sectoral approaches[39]. Framing decarbonisation as a way to reduce energy dependence and price volatility, rather than only as an environmental imperative, can help sustain public and political backing for measures that might otherwise be perceived as costly or disruptive in the short term. The emphasis on digitalisation and system integration can also create opportunities for more flexible, efficient, and resilient energy systems. Smart grids, demand-response schemes, and better data on consumption patterns can enable a more fine-grained matching of supply and demand and facilitate higher shares of variable renewables[40]. At the same time, coordinated investment strategies at the EU level – combined with multi-level governance arrangements that involve member states, regions, and local authorities – provide scope for policy experimentation, learning, and the diffusion of good practices[41].

[33] Dekeyrel, S., Fessler, M. (2024). Digitalisation: an enabler for the clean energy transition. Journal of Energy & Natural Resources Law 42, 2, 185-209, https://doi.org/10.1080/02646811.2023.2254103
[34] Paraná, E., Santaella-Gonçalves, R. (forthcoming). Capital, Code, and Nature: Problematising the 'Twin Transition'. Globalizations. http://dx.doi.org/10.1080/14747731.2025.2601917.
[35] Sareen, S., Müller, K. (2023). Digitisation and Low-Carbon Energy Transitions. Cham: Palgrave Macmillan.
[36] Brodie, P. (2024). Smarter, greener extractivism: digital infrastructures and the harnessing of new resources. Information, Communication & Society 28, 6, 1061–1080. https://doi.org/10.1080/1369118X.2024.2341013
[37] Fifi, G. (2025). Towards a political economy of the green transition. Journal of European Integration 47, 7, 1129–1134. https://doi.org/10.1080/07036337.2025.2567829
[38] European Commission (2019). The European Green Deal.
[39] European Commission. (2022). Towards a green, digital and resilient economy: Our European Growth Model.
[40] European Commission. (2019). The European Green Deal.
[41] European Commission. (2022). REPowerEU.

2.3 Connection with Multi-level Governance

The strategic documents analysed above implicitly rely on a dense architecture of multi-level governance, even though this dimension is not always made explicit. The redefinition of secure energy as a structural transformation of the energy system presupposes coordination across EU institutions, member states, regional authorities, and, in many cases, local actors and private stakeholders. At the EU level, the EGD, the Growth Model Communication, and REPowerEU provide strategic direction, regulatory frameworks, and financial instruments. Through mechanisms such as the RRF, the revision of the TEN-E Regulation, and guidance on energy poverty, the EU sets common objectives and mobilises investment at scale. However, implementation largely remains in the hands of member states, which retain primary competence over energy mix, infrastructure planning, and social policy instruments. Energy security thus operates within a shared but asymmetrical governance structure, in which the EU defines overarching goals while national authorities translate them into concrete measures.

This allows for contextual adaptation, experimentation, and differentiated pathways towards decarbonisation; however, it risks uneven implementation and territorial disparities, particularly in areas such as building renovation, energy efficiency programmes, and the mitigation of energy poverty. The strategic documents' emphasis on coordinated investments "at all levels" implicitly recognises that secure energy cannot be achieved through EU-level regulation alone but depends on alignment across governance tiers. Horizontal coordination is equally central. The vision of a fully integrated and interconnected internal energy market presupposes solidarity and cooperation among member states. Cross-border interconnections, shared infrastructure planning, and regional energy cooperation create mutual dependencies that can enhance resilience but also require stable institutional arrangements and trust. In this sense, energy security in the EU is increasingly relational: it depends not only on national capacity but on the robustness of collective governance mechanisms.

Moreover, the growing role of digitalisation and system integration introduces additional governance layers. Smart grids, data-driven optimisation, and cross-border electricity balancing involve regulatory authorities, transmission system operators, distribution system operators, and private technology providers operating across jurisdictions. Ensuring that digital infrastructures enhance rather than undermine energy security requires coordination between energy regulation, data governance, and cybersecurity frameworks, linking energy security to broader questions of institutional capacity and regulatory coherence.

Finally, the social dimension of secure energy further reinforces the multi-level character of the agenda. While EU documents recognise energy poverty as a structural concern, concrete policy design and delivery — including renovation schemes, targeted subsidies and local support programmes — typically occur at national or subnational levels. This creates a governance configuration in which the EU articulates normative objectives of fairness and inclusion, but member states and local authorities determine how these objectives are implemented in practice.

Taken together, the strategic documents construct energy security as a transformation project that inherently depends on MLG. Secure energy is not achieved solely through technological innovation or market integration, but through sustained coordination across vertical and horizontal governance structures. The effectiveness and equity of the EU's secure energy agenda, therefore, hinge not only on policy ambition but on the institutional capacity and coherence of its multi-level governance architecture.

3. Clean and sustainable economy

The EU's clean and sustainable economy refers to an economic model aimed at rapidly reducing GHG, lowering resource consumption, and protecting ecosystems in a socially equitable manner while maintaining growth and competitiveness[42]. The EGD and the European Climate Law reinforce this vision by setting legally binding targets for achieving climate neutrality by 2050 and reducing emissions by 90% by 2040, and by linking these targets to industrial policy, energy, agriculture, transport, and social inclusion[43]. Sectoral frameworks such as the Farm to Fork Strategy, the Circular Economy Action Plan, the Zero Pollution and Biodiversity Strategy, and the Fit for 55 Package are reorienting production and consumption toward low-carbon energy, circular resource flows, healthier food systems, and pollution reduction[44]. Sustainable finance and recovery tools, including the EU taxonomy, the Next Generation EU program, the just transition mechanism, the Social Climate Fund, and the REPowerEU initiative, aim to channel public and private investment toward green infrastructure, clean technologies, and skills retraining, with support for vulnerable regions and households[45].

3.1 Key Strategic Documents and Core Legislative Guidelines

The EGD's cross-sectoral framework encompasses climate, energy, industry, agriculture, biodiversity, and finance, promoting circularity, zero pollution, and mandating a just transition that ensures fairness for communities and workers affected by structural economic changes[46].The EGD aims to transform Europe's economy into a modern, resource-efficient, and competitive system by investing in innovation, clean technologies, green infrastructure, sustainable mobility, and ecosystem restoration. The Green Deal Industrial Plan supports net-zero technologies, while initiatives like the Circular Economy Action Plan promote product durability, recycling, and waste reduction[47]. The latter includes accelerated permitting for renewables and infrastructure for electric vehicles, as well as extensive legislation on air and water quality and biodiversity protections[48].

[42] European Commission (2019). The European Green Deal; European Commission (2021). Fit for 55 package: Delivering the EU's 2030 climate target on the way to climate neutrality, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0550

[43] European Commission (2019). The European Green Deal; European Union. (2021). Regulation (EU) 2021/241 establishing the Recovery and Resilience Facility, https://eur-lex.europa.eu/eli/reg/2021/241/oj/eng.

[44] European Commission (2019). The European Green Deal; European Commission (2020). Circular Economy Action Plan: For a cleaner and more competitive Europe, https://eur-lex.europa.eu/resource.html?uri=cellar%3A9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF; European Commission (2021). Fit for 55 package; Kovacic, Z., García Casañas, C., Argüelles, L., et al. (2024). The twin green and digital transition: High-level policy or science fiction? Environment and Planning E: Nature and Space, 7, 6, 2251–2278. https://doi.org/10.1177/25148486241258046

[45] European Commission (2025). REPowerEU: Affordable, secure and sustainable energy for Europe; European Commission (2020). The Just Transition Mechanism: making sure no one is left behind, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en; Bornemann, B., Christen, M., & Burger, P. (2024). The sustainable state: a meta-governance framework. Environmental Politics, 34, 2, 344–366. https://doi.org/10.1080/09644016.2024.2369015; European Union. (2021). Regulation (EU) 2021/241 establishing the Recovery and Resilience Facility, https://eur-lex.europa.eu/eli/reg/2021/241/oj/eng

[46] European Commission (2019). The European Green Deal; European Commission (2020). Circular economy action plan.

[47] European Commission (2019). The European Green Deal; European Environmental Agency (2020). The European environment – state and outlook 2020: Knowledge for transition to a sustainable Europe, https://www.eea.europa.eu/publications/soer-2020

[48] European Commission (2020). Circular economy action plan; Ersoy Mirici, M. (2022). The ecosystem services and green infrastructure: A systematic review and the gap of economic valuation. Sustainability, 14, 1, 517. https://doi.org/10.3390/su14010517

Economic modernisation under the EGD requires significant investment, estimated at about 2% of the EU's GDP annually through 2030, fostering growth in clean technology sectors. The Just Transition Mechanism (JTM) provides financial support and reskilling programmes, especially targeting vulnerable regions and workers dependent on fossil fuels, to ensure socially fair economic diversification and human capital development[49]. Broader sustainability goals embedded in the EGD include sustainable food systems, with targets for organic farming, pesticide reduction, and minimising food waste. It also emphasises restoring ecosystems, enhancing biodiversity, and leveraging digital technologies to support the green transition and smart infrastructure[50]. These measures make the EGD a key driver in the EU's transition to a clean and sustainable economy, closely linking economic growth with decarbonisation, resource efficiency, and a circular economy. These measures also guide investment in renewable energy, sustainable industries, and nature-based solutions, strengthening value chains, creating high-quality green jobs, and improving competitiveness while reducing emissions[51].

The Farm to Fork Strategy is a pivotal part of the EGD, focused on transforming food systems to significantly reduce the environmental and climate impacts of agriculture and food production by encouraging sustainable farming practices, reducing chemical use, and promoting organic and agroecological methods[52]. A major goal of the strategy is to cut GHG emissions from food systems by 55% by 2030, while also enhancing biodiversity, soil health, and water management[53]. It promotes reduced pesticide and fertiliser use, targeting a 50% reduction in each by 2030, to limit pollution and biodiversity loss. Additionally, the strategy seeks to reduce food waste through several[54]. Through these measures, the Farm to Fork Strategy contributes holistically to the EU's clean and sustainable economy objectives by aligning environmental, economic, and social sustainability goals[55]. In summary, the Farm to Fork Strategy contributes to a clean and sustainable EU economy by reducing agricultural emissions, pesticides, and fertilizers, and promoting organic methods that protect soil, water, and biodiversity as economic resources.

The JTM ensures that the transition to a climate-neutral economy happens in a fair and inclusive way, leaving no one behind. It provides targeted support for regions, industries, workers, and vulnerable populations most affected by the shift from carbon-intensive activities to sustainable alternatives. The JTM mobilises around €55 billion for the period 2021-2027 through three pillars: the Just Transition Fund (JTF), the InvestEU Just Transition Scheme, and the Public Sector Loan Facility; the JTF, with a budget of nearly €20 billion, focuses on financing Territorial Just Transition Plans prepared by member states[56]. These plans identify the regions most affected by the phase-out of fossil fuels and carbon-intensive industries, and outline strategies for economic diversification, job creation, infrastructure development, and reskilling workers to prepare for the

[49] European Commission (2020). The Just Transition Mechanism; European Parliament (2020). The Green Deal's growth, financial and regulatory challenges, https://www.europarl.europa.eu/RegData/ etudes/ATAG/2020/648800/IPOL_ATA(2020)648800_EN.pdf; European Commission (2019). The European Green Deal.
[50] European Commission (2020). The Just Transition Mechanism; ECDPM (2025). How the EU's Vision for Agriculture and Food could shape global food security and climate change; https://ecdpm.org/work/how-eus-vision-agriculture-and-food-could-shape-global-food-security-and-climate-change; Ersoy Mirici, M. (2022).
[51] European Commission (2019). The European Green Deal; European Environmental Agency (2020). The European environment – state and outlook 2020.
[52] European Commission (2020). Farm to Fork Strategy: For a fair, healthy and environmentally-friendly food system, https://ec.europa.eu/food/farm2fork_en
[53] European Commission (2019). The European Green Deal.
[54] Giannou, C. (2022). Farm to Fork: EU's strategy for a sustainable food system. HAPSc Policy Briefs Series, 3, 1, 189–198. https://doi.org/10.12681/hapscpbs.31008
[55] European Commission (2020). Farm to Fork Strategy; Giannou, C. (2022).
[56] European Commission (2019). The European Green Deal; European Commission (2020). The Just Transition Mechanism.

green economy[57]. It assists companies and sectors transitioning towards low-carbon technologies by providing financial and technical support to foster innovation, green investments, and sustainable business development[58]. Overall, the JTM embodies the social dimension of the EU's clean and sustainable economy, addressing socio-economic challenges alongside environmental goals to foster a just green transition in Europe[59].

The EU Circular Economy Action Plan (CEAP), adopted in March 2020, is a fundamental element of the EGD that propels a transformative shift toward sustainability throughout the entire lifecycle of products[60]. The CEAP specifically targets resource-intensive sectors with high circularity potential, such as electronics, textiles, plastics, construction, and food, applying more ambitious standards for resource efficiency and waste reduction to propel the green transition[61]. At the heart of the plan is the Eco-design for Sustainable Products Regulation (ESPR), which extends sustainability requirements far beyond energy-related goods. It mandates new standards for product durability, reparability, recyclability, and transparency for nearly all physical products marketed within the EU[62]. A key innovation under this regulation is the phased introduction of Digital Product Passports (DPPs) starting in 2024, tools that enable comprehensive material tracing, real-time monitoring of sustainability credentials, and streamlined regulatory enforcement[63].

Together, these measures foster new circular business models, stimulate innovation in remanufacturing and recycling technologies, and encourage consumer demand for sustainable products. There was a 6% growth in circular economy employment between 2012 and 2016, alongside the widespread development of regional and national circular strategies across member states[64]. The CEAP's legal and strategic frameworks mainstream circularity into economic production and consumption patterns, thereby directly supporting the EU's overarching goals of achieving climate neutrality and fostering a clean, sustainable economy[65].

The EU Taxonomy Regulation, enacted in 2020, establishes a classification system for environmentally sustainable economic activities, forming a cornerstone of the EU's sustainable finance agenda[66]. The Taxonomy defines clear technical screening criteria to determine whether an activity substantially contributes to climate mitigation, climate adaptation, the circular economy transition, pollution prevention, water and marine resource protection, or biodiversity conservation. This creates a unified 'green list' that helps guide sustainable investment decisions

[57] European Commission (2020). The Just Transition Mechanism.
[58] Housing Europe (2023). Just Transition Mechanism, https://www.housingeurope.eu/just-transition-mechanism-2/; World Resources Institute (2021). European Union's Just Transition Mechanism: Transnational Funding and Support for a Just Transition. https://www.wri.org/snapshots/european-unions-just-transition-mechanism-transnational-funding-and-support-just
[59] European Commission (2019). The European Green Deal.
[60] European Commission (2020). Circular Economy Action Plan.
[61] Kamali Saraji, M., & Torabi, M. (2025). Progress Toward a Circular Economy: A Comparative Analysis of EU Member States. Sustainability, 17, 18, 8448, https://doi.org/10.3390/su17188448
[62] European Commission (2024). Ecodesign for Sustainable Products Regulation: Making sustainable products the norm in the EU. https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en
[63] Neligan, A., Schleicher, C., Engels, B., et al. (2023). Digital product passport as enabler for the circular economy, https://circulareconomy.europa.eu/platform/sites/default/files/2024-02/IW-Report_2023-Digitaler-Produktpass-englisch.pdf; Circularise. (2025). Digital Product Passports required by EU legislation across sectors: ESPR, toys, detergents, batteries, and more, https://www.circularise.com/blogs/dpps-required-by-eu-legislation-across-sectors
[64] Kamali Saraji, M., & Torabi, M. (2025).
[65] European Commission. (2020). Circular Economy Action Plan.
[66] European Commission. (2023). EU taxonomy for sustainable activities. https://finance.ec.europa.eu/regulation-and-supervision/financial-services-legislation/implementing-and-delegated-acts/sustainable-finance-disclosures-regulation_en



across Europe, enhancing clarity and consistency in sustainability assessments[67]. Supporting this framework, the Sustainable Finance Disclosure Regulation (SFDR) and the Benchmark Regulation incorporate the EU Taxonomy's requirements into EU recovery and investment programs. These regulations emphasise rigorous transparency in sustainability reporting and require projects to adhere to the "Do No Significant Harm" principle, intended to prevent any adverse environmental or social impacts[68]. Together, these measures reduce the risk of greenwashing, strengthen market integrity, and direct private capital flows toward decarbonisation and green innovation[69].

Major EU funding instruments, including NextGenerationEU, InvestEU, and the JTF allocate tens of billions of euros to facilitate the transition to a low-carbon economy[70]. These instruments also prioritise social fairness and drive systemic transformation in both private-sector investment behaviour and public financial management. They ensure that economic growth aligns with the overarching climate-neutrality goals of the EGD, strengthening the link between financial flows, environmental sustainability, and social equity in the EU's transition to a clean, sustainable economy[71].

The European Climate Law enshrines a just transition approach, emphasising social fairness by supporting vulnerable regions and workers affected by structural economic shifts driven by decarbonisation. It also mandates sector-specific roadmaps to chart pathways toward climate neutrality, fosters enhanced carbon sinks through ambitious land-use regulations, and establishes the European Scientific Advisory Board on Climate Change to provide independent scientific guidance[72]. Additionally, the law is dynamic; an amendment adopted in 2026 established even more ambitious interim targets, a 90% emission reduction by 2040, reflecting the EU's commitment to progressively strengthening its climate ambition[73]. Overall, the European Climate Law mandates cumulative action across policies and sectors, enforces transparent governance, and institutionalises climate goals as core to Europe's economic and social fabric, thus driving the EU's systemic shift toward climate neutrality and sustainability[74].

The Fit for 55 packages, launched in 2021, is a comprehensive and transformative legislative reform initiative designed to operationalise the ambitious climate targets established by the EGD. It aims to reduce GHG emissions by at least 55% by 2030 compared to 1990 levels, significantly enhancing the EU's climate and energy regulatory framework[75]. The package entails revisions to key laws, including the Emissions Trading System (ETS), the Effort Sharing Regulation, and the Renewable Energy Directive, thereby reinforcing the EU's leadership in the transition to a clean and sustainable economy. A central element of Fit for 55 is the Carbon Border Adjustment Mechanism (CBAM), which introduces a carbon price on imports from countries with less stringent climate policies. This mechanism serves to prevent carbon leakage – where production moves to regions with lax environmental regulations – and incentivises cleaner manufacturing globally.

[67] European Commission. (2023). Implementing and delegated acts - Taxonomy Regulation, https://finance.ec.europa.eu/regulation-and-supervision/financial-services-legislation/implementing-and-delegated-acts/taxonomy-regulation_en

[68] European Commission. (2020). Sustainable finance, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en

[69] Ibid.

[70] European Commission. (2023). EU taxonomy for sustainable activities; European Commission (2023). Implementing and delegated acts - Taxonomy Regulation.

[71] European Commission (2020). Sustainable finance; European Commission (2023). EU taxonomy for sustainable activities.

[72] European Commission (2023). Progress Report 2023; European Commission (2021). European Climate Law.

[73] Zero Emissions Platform. (2025). Recommendations for the EU Climate Law amendment, https://zeroemissionsplatform.eu/publication/recommendations-for-the-eu-climate-law-amendment/

[74] Regulation (EU) 2026/667.

[75] European Commission. (2021). Fit for 55 package.

CBAM protects the EU's industrial competitiveness while supporting broader international climate goals[76].

In the energy sector, the revised Renewable Energy Directive mandates that at least 42.5% of the EU's energy mix be sourced from renewables by 2030. This target drives a rapid scale-up of clean energy deployment across member states. The package also emphasises energy efficiency through enhanced standards for building renovations and promotes integration of cross-border electricity markets to manage the variability inherent in renewable generation[77]. Beyond environmental benefits, Fit for 55 is expected to deliver substantial socio-economic advantages, including net job creation, increased innovation in low-carbon industries, and the promotion of a more equitable, competitive, and resilient European economy. It strategically integrates climate ambition with social and economic policies to ensure fairness and broad-based prosperity during the transition[78].

The Fit for 55 package is directly linked to a clean, sustainable economy by shifting the EU's growth model from fossil fuels to renewable energy, improving efficiency, and promoting low-carbon innovation. By tightening carbon pricing through mechanisms like the ETS and CBAM, raising renewable energy targets, and enhancing energy efficiency, it guides investment, jobs, and trade rules toward climate-neutral production while safeguarding competitiveness and social fairness. Altogether, 'Fit for 55' operationalizes the EGD's climate goals via a unified policy framework that accelerates emissions reductions, modernizes energy systems, protects industrial competitiveness, and fosters a just transition[79].

The EU's Zero Pollution Action Plan (2021) sets highly ambitious targets to drastically reduce pollution across air, water, and soil, building on and reinforcing key existing legislative frameworks like the Industrial Emissions Directive (IED) and the Water Framework Directive. It envisions a future in which pollution levels are minimised to levels that no longer harm human health or ecosystems by 2050[80]. By 2030, the plan[81] seeks a 55% reduction in premature deaths from air pollution relative to 2005, alongside significant curbs in plastic waste, microplastics, nutrient losses, and hazardous pesticide use. Complementing this ambitious framework, the Biodiversity Strategy for 2030 presents legally binding objectives to restore and protect at least 30% of the EU's land and marine territories. It incorporates ecosystem restoration and promotes sustainable land-use practices to preserve biodiversity and enhance habitat resilience[82].

Additional strategic tools, such as the Chemicals Strategy for Sustainability and amendments to the Waste Shipment Regulation, further reduce hazardous substances and improve oversight of waste exports, reinforcing the EU's zero pollution ambitions[83]. These documents aim to create

[76] European Union. (2024). Carbon Border Adjustment Mechanism (CBAM), https://eur-lex.europa.eu/EN/legal-content/summary/carbon-border-adjustment-mechanism.html.

[77] European Association for Storage of Energy. (2024). Renewable Energy Directive Revision Briefing, https://energystorageeurope.eu/wp-content/uploads/2024/10/2024_EASE_RED_LINKS.pdf; Schlacke, S., Wentzien, H., Thierjung, E.-M., et al. (2022). Implementing the EU Climate Law via the 'Fit for 55' package. Oxford Open Energy, 1, oiab002, https://doi.org/10.1093/ooenergy/oiab002.

[78] Eurofound. (2023). Fit for 55 climate package: Impact on EU employment by 2030, https://www.eurofound.europa.eu/en/publications/all/fit-55-climate-package-impact-eu-employment-2030; OECD (2025). Building Climate, Economic and Social Resilience, https://www.oecd.org/en/about/programmes/net-zero-building-climate-and-economic-resilience.html.

[79] European Commission (2021). Fit for 55 package; Schlacke, S., Wentzien, H., Thierjung, E.-M. et al. (2022).

[80] European Commission (2021). EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil', https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0400&qid=1623311742827

[81] Ibid.; European Commission. (2020). Biodiversity strategy for 2030, https://ec.europa.eu/environment/ strategy/biodiversity-strategy-2030_en

[82] Ibid.

[83] European Commission. (2020). Chemicals Strategy for Sustainability: Towards a toxic-free environment, https://ec.europa.eu/commission/presscorner/api/files/attachment/866620/ Chemicals%20Strategy%20EN.pdf; European



healthier environments, boost sustainable industrial practices, and enhance citizen well-being, laying a robust environmental foundation essential for achieving a just and sustainable economic transition in the EU[84].

The EU ETS is a central instrument in the EU's approach to advancing a clean and sustainable economy by reducing GHG through a cap-and-trade mechanism. Covering thousands of industrial facilities and aviation, it enforces a progressively lower emissions cap to drive innovation and investment in low-carbon technologies, helping the EU meet its climate goals[85]. Despite initial challenges such as free permit allocations, studies show that the EU ETS effectively reduced emissions by around 7.5% in covered sectors from 2008 to 2016, without economic harm or carbon leakage, while fostering energy independence and clean technology adoption[86]. Enhancements such as ETS 2 further expand the system's role in the EU's twin transition to a sustainable, digital economy[87].

The Social Climate Fund (SCF) is a key instrument in the EU's clean and sustainable economy agenda designed to mitigate the social and economic impacts of the expanded ETS, which now includes sectors such as buildings and road transport[88]. It aims to ensure a just and fair transition to climate neutrality by supporting vulnerable groups, including households, facing energy or transport poverty. The fund provides member states with dedicated financial resources to implement structural measures and investments like energy efficiency improvements, building renovations, clean heating/cooling, renewable energy integration, and low-emission mobility solutions[89]. Furthermore, the SCF enables temporary direct income support to alleviate immediate financial burdens. Member states are required to submit Social Climate Plans, based on extensive stakeholder consultations, that outline measures to protect vulnerable populations[90]. The SCF is financed through auction revenues from the ETS2 and additional ETS allowances, expected to mobilise at least €86.7 billion between 2026 and 2032, with at least 25% co-financing from member states[91].

The Carbon Border Adjustment Mechanism (CBAM) is designed to address carbon leakage by applying a carbon price on imports of certain carbon-intensive goods. It ensures that imported products bear an equivalent carbon cost to those produced within the EU under the ETS, thus

Commission. (2023). Waste Shipments, https://environment.ec.europa.eu/topics/waste-and-recycling/waste-shipments_en

[84] European Commission (2021). EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'; European Commission. (2020). Biodiversity strategy for 2030.

[85] Teixidó, J., Verde, S. F., & Nicolli, F. (2019). The impact of the EU Emissions Trading System on low-carbon technological change: The empirical evidence. Ecological Economics, 164, 106347. https://doi.org/10.1016/j.ecolecon.2019.06.002; European Central Bank (2024). The effects of the Emissions Trading System on European investment in the short run. ECB Economic Bulletin, Issue 8, shttps://www.ecb.europa.eu/press/economic-bulletin/focus/2025/html/ecb.ebbox202408_02~55e30afb57.sl.html

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[87] Clean Energy Wire (2024). Understanding the European Union's Emissions Trading Systems (EU ETS), https://www.cleanenergywire.org/factsheets/understanding-european-unions-emissions-trading-system

[88] European Commission (2024). Social Climate Fund - EU action, https://climate.ec.europa.eu/eu-action/carbon-markets/social-climate-fund_en

[89] Solidar. (2022). Social climate fund: A major step forward in the delivery of a just transition, https://www.solidar.org/wp-content/uploads/2024/02/briefing_paper_102_-_social_climate_fund.pdf

[90] Baute, S. (2024). The distributive politics of the green transition: a conjoint experiment on EU climate change mitigation policy. Journal of European Public Policy 32, 1, 52–80. https://doi.org/10.1080/13501763.2024.2304609

[91] European Commission (2024). Social Climate Fund - EU action.



levelling the playing field between EU and non-EU producers[92]. It initially covers sectors such as cement, iron and steel, aluminium, fertilisers, electricity, and hydrogen, which are among the most carbon-intensive and at risk of carbon leakage. CBAM incentivises cleaner production methods globally and prevents the outsourcing of emissions to countries with laxer climate policies[93]. Minimising carbon leakage, CBAM enhances the effectiveness of the ETS, doubling the global impact on emission reductions. The mechanism is expected to expand its scope to include more sectors vulnerable to carbon leakage, reinforcing the green transition while safeguarding the competitiveness of EU industry[94]. Revenues generated by CBAM are anticipated to support European climate policies and investments, further aligning trade policy with sustainability objectives[95].

The REPowerEU Plan is a comprehensive EU strategy launched in response to the energy crisis triggered by Russia's invasion of Ukraine, aiming to reduce the EU's dependence on Russian fossil fuels while accelerating the clean energy transition. Its core pillars include saving energy through efficiency improvements, diversifying energy supplies by securing alternative sources such as LNG, and massively scaling up renewable energy production, targeting to produce 45% of the EU's energy from renewables by 2030[96]. The plan mobilises around €300 billion in investments, partly financed by revenues from the ETS, to turbocharge renewable energy infrastructure, improve energy efficiency, and foster industrial decarbonization. REPowerEU increases renewable energy capacity through initiatives such as the EU Solar Strategy, which aims to double solar photovoltaic capacity and accelerate wind power deployment. Besides infrastructure, the plan includes social measures, such as energy-efficiency subsidies for vulnerable households and workforce retraining, to ensure a just transition[97]. By intertwining energy security with sustainability, REPowerEU plays a strategic role in Europe's ambitions for a clean, sustainable economy, enhancing energy independence while advancing the EU's 2030 and 2050 climate targets[98].

The Net-Zero Industry Act (NZIA) is an EU policy designed to bolster the manufacturing capacity and global competitiveness of the clean technology sector[99]. The Act aims to ensure that at least 40% of the EU's annual deployment needs for strategic net-zero technologies – such as solar panels, batteries, wind turbines, heat pumps, and hydrogen electrolysers – are met within the

[92] European Commission (2024). Carbon Border Adjustment Mechanism, https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en; OECD. (2025). EU Carbon Border Adjustment Mechanism: What is it, how does it work and what are the effects? https://www.oecd.org/en/blogs/2025/03/eu-carbon-border-adjustment-mechanism-what-is-it-how-does-it-work-and-what-are-the-effects.html

[93] Ramboll (2025). The Carbon Border Adjustment Mechanism: Rewiring trade for a low-carbon economy, https://www.ramboll.com/insights/decarbonise-for-net-zero/the-carbon-border-adjustment-mechanism-rewiring-trade-for-a-low-carbon-economy; Climate Leadership Coalition (2025). Protecting a level playing field in climate policy through the rapid and effective implementation of the Carbon Border Adjustment Mechanism, https://www.clc.fi/proposals-and-statements/protecting-a-level-playing-field-in-climate-policy-through-the-rapid-and-effective

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[95] European Commission (2024).

[96] European Commission (2025). REPowerEU: Affordable, secure and sustainable energy for Europe; Asuene. (2025). RepowerEU: Redefining Europe's Clean Energy Security in a Post-Crisis World, https://asuene.com/us/blog/repowereu-redefining-europes-clean-energy-security-in-a-post-crisis-world

[97] European Commission (2025). REPowerEU: Affordable, secure and sustainable energy for Europe; Fortum. (2022). REPowerEU and its impact on the green energy transition, https://www.fortum.com/newsroom/forthedoers-blog/repowereu-and-its-impact-green-energy-transition

[98] Siddi, M. (2023). Europe's policies for a green transition: The European Commission's geopolitical turn and its pitfalls. Finnish Institute of International Affairs, https://fiia.fi/en/publication/europes-policies-for-a-green-transition

[99] European Commission. (2023). The Net-Zero Industry Act, https://commission.europa.eu/topics/competitiveness/green-deal-industrial-plan/net-zero-industry-act_en

Union by 2030[100]. It creates a supportive regulatory framework that streamlines permit procedures, prioritises net-zero strategic projects, and introduces sustainability criteria in public procurement. The NZIA also established the Net-Zero Europe Platform, which facilitates cooperation among EU countries and stakeholders to monitor progress, advise on financing, and foster international partnerships. Additionally, the Act is aligned with the complementary Critical Raw Materials Act, which ensures reliable supply chains for essential materials, thereby strengthening the EU's autonomy and resilience in the clean energy economy[101]. This holistic approach targets economic growth, job creation, and sustainability, marking the NZIA as a decisive industrial policy instrument supporting the EU's clean and sustainable economic objectives.

3.2 Obstacles and Limitations

Despite its ambitious architecture, the EU's clean and sustainable economy agenda faces significant structural, political, and socio-economic constraints that risk slowing or distorting the transition. First, the scale and speed of the required investment remain a major obstacle. The EGD alone is projected to require an additional investment of approximately 2% of the EU's GDP annually by 2030, yet public budgets are under pressure, and private capital remains poorly aligned with long-term climate and circular economy goals. Despite the significant resources mobilized through mechanisms such as NextGenerationEU, InvestEU, JTM, SCF, and REPowerEU, scholars note that funding gaps persist in local implementation, social infrastructure, and adaptation, and that access to financing remains unequal between wealthy and impoverished regions[102]. These disparities have the potential to exacerbate existing socio-geographical inequalities and undermine the principle of 'no one left behind'.

Second, the complexity and fragmentation of governance pose serious limitations. The proliferation of various strategies – the EGD, Farm to Fork, CEAP, Fit for 55, the Zero Pollution, the Biodiversity Strategy, NZIA, CBAM, ETS reforms – has created a complex policy environment that is sometimes lacking in coherence, with overlapping responsibilities, conflicting timelines, and inconsistent enforcement capabilities. MLG research points out that there are vertical misalignments between the EU, national, and regional levels, as well as horizontal barriers between departments, ministries, and agencies, which may delay implementation, weaken ambition, and create regulatory uncertainty[103]. The success of tools such as territorial justice transition programs, multi-level climate and energy dialogues, or social climate programs depends

[100] Ibid.; Ideopsis. (2025). Net Zero Industry Act explained, https://ideopsis.com/net-zero-industry-act-explained/.
[101] Hinen. (2025). The EU's Net-Zero Industry Act and Critical Raw Materials Act: Accelerating Europe's Green Transition, https://www.hinen.com/blogs/energy-storage/eu-net-zero-industry-act-critical-raw-materials-act-green-transition;
[101] Van Doorne. (2025). EU Clean Industrial Deal and the Net-Zero Industry Act, https://www.vandoorne.com/en/artikelen/eu-clean-industrial-deal-and-the-net-zero-industry-act/
[102] European Commission. (2022). REPowerEU Plan; European Commission. (2023). Just Transition Mechanism. Brussels: European Commission, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en; European Commission. (2023). Social Climate Fund. Brussels: European Commission, https://commission.europa.eu/social-climate-fund_en; Maucorps, A., Römisch, R., Schwab, T., & Vujanović, N. (2023). The impact of the green and digital transition on regional cohesion in Europe. Intereconomics 58, 2, 102–110, https://10.2478/ie-2023-0021.
[103] Council of Europe. (2023). Report on multilevel governance [CDDG(2023)12]. Strasbourg: Directorate General of Democracy and Human Dignity, https://rm.coe.int/report-on-multilevel-governance-final-2768-6653-0568-v-1/1680ad9120; Gao, X. (2025). The EU's twin transitions towards sustainability and digital leadership: a coherent or fragmented policy field? Regional Studies 59, 1, https://doi.org/10.1080/00343404.2024.2360053.

on administrative capacity, which is unevenly distributed and often weakest in areas of greatest need[104].

Third, socio-political resistance and distributional conflicts limit the transformative potential of many measures. Policies such as extending the ETS, implementing the CBAM, adopting stricter eco-design rules, or setting ambitious pesticide-reduction targets may provoke strong opposition from industries, farmers, and households who fear rising costs, unemployment, or over-regulation[105]. Even with buffers such as equitable transition mechanisms and social climate funds, the risk of 'green fatigue' or populist mobilization against climate policies remains if social impacts are not credibly and transparently[106] managed. Procedural deficiencies – limited participation, uneven transparency, and complex technical language – further undermine legitimacy and trust, particularly in regions historically marginalized in EU decision-making[107].

Fourth, industrial and geopolitical dependence limit the EU's room for manoeuvring. The NZIA and the Critical Raw Materials Act aim to develop domestic clean technology capabilities and secure critical supply chains, but in the short to medium term, the EU remains heavily reliant on imported technologies, fuels, and raw materials[108]. Global competition between the US and China, trade disputes, and volatile energy markets could delay investment or force policymakers to relax environmental standards to maintain competitiveness[109]. Mechanisms such as the CBAM also face legal and diplomatic challenges within the World Trade Organization and could trigger retaliation, further complicating their implementation. Finally, policy coordination among environmental, social, and digital transformation has not yet been fully achieved. Digital strategies are not always aligned with decarbonisation and the circular economy, and if poorly managed, may even increase energy demand and resource extraction[110]. Similarly, expediting approval processes for renewable energy, green industries, or the extraction of critical raw materials could conflict with biodiversity, zero pollution, local equity, and justice.

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[104] CINEA. (2023). National Energy and Climate Plans (NECPs) overview. European Climate, Infrastructure and Environment Executive Agency, https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en; von Malmborg, F., Björklund, M., & Nordensvärd, J. (2022). Multi-level governance and policy for a transition towards energy efficient and zero-carbon buildings in the European Union (IEI Research Report No. LIU-IEI-RR-22/00342-SE). Linköping University, Department of Management and Engineering, https://www.diva-portal.org/smash/get/diva2:1666037/FULLTEXT02

[105] Kovacic, Z., García Casañas, C., Argüelles, L. et al. (2024). The twin green and digital transition: High-level policy or science fiction? Environment and Planning E: Nature and Space 7, 6, 2251-2278. https://doi.org/10.1177/25148486241258046; Kulovesi, K., Oberthür, S., van Asselt, H., et al (2024).

[106] Bornemann, B., Christen, M., & Burger, P. (2025). The sustainable state: a meta-governance framework. Environmental Politics 34, 2, 344–366. https://doi.org/10.1080/09644016.2024.2369015; Bunea, A., & Nørbech, I. (2023). Preserving the old or building the new? Reputation-building through strategic talk and engagement with stakeholder inputs by the European Commission. Journal of European Public Policy 30, 9, 1762–1792. https://doi.org/10.1080/13501763.2022.2099450

[107] Council of Europe. (2023). Report on multilevel governance; Niet, I. (2024). EU public values governing the twin transition. Review of European, Comparative & International Environmental Law 33, 3, 452–461. https://doi.org/10.1111/reel.12579

[108] European Commission. (2023). A Green Deal Industrial Plan for the Net-Zero Age. Brussels: European Commission. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52023DC0062; Kovacic, Z., García Casañas, C., Argüelles, L., et al. (2024).

[109] Maucorps, A., Römisch, R., Schwab, T., et al. (2023). The impact of the green and digital transition on regional cohesion in Europe. Intereconomics 58, 2, 102–110. https://10.2478/ie-2023-0021; Euromanet. (2024). Report on economic, social and territorial cohesion: Achievements, challenges and lessons learned. Euromanet Network. https://www.euromanet.eu/news/report-on-economic-social-and-territorial-cohesion-achievements-challenges-and-lessons-learned/.

[110] Kovacic, Z., García Casañas, C., Argüelles, L., et al. (2024); Muñoz de Bustillo Llorente, R. (2024). A critical review of the digital and green twin transitions: Implications, synergies and trade-offs (JRC Working Papers on Labour, Education and Technology, 2024/07). Joint Research Centre, https://publications.jrc.ec.europa.eu/repository/bitstream/JRC140036/JRC140036_01.pdf

3.3 Connection with Multi-level Governance

Decarbonisation and structural transformation depend on coordinated action among EU, national, regional, and local levels, as well as among public institutions, the private sector, and civil society[111]. MLG is viewed not only as the context for policy implementation but also as a constitutive governance model that shapes the definition, resource allocation, and legitimacy of climate and sustainable development policies[112]. It enhances the effectiveness, equity, and legitimacy of governance at all levels by combining top-down regulatory objectives with bottom-up innovation and regional needs[113]. The EGD, the European Climate Law, the Fit for 55 package, and the REPowerEU initiative have reshaped the vertical and horizontal governance interfaces within the EU's climate architecture[114]. By strengthening procedural obligations (such as participatory planning, monitoring, and long-term strategy development), these frameworks promote more integrated governance but also entail risks of complexity, opacity, and uneven administrative capacity across member states and regions[115].

Tools such as the JTM, the Social Climate Fund, and territorial just transition initiatives require joint planning and stakeholder participation to translate EU-wide norms of climate justice and social equity into concrete, regionally based actions[116]. Similarly, the policy framework for decarbonising the circular economy, eco-design, and building sectors relies on iterative coordination among EU-level standards, national implementation systems, and local pilot projects[117]. These cases demonstrate how multi-level governance can support policy learning, incentive coordination, and the practical application of innovative technologies and business models at different governance levels. MLG has shaped the operational mechanisms of tools such as the CEAP, the Eco-Design Regulation, and the Farm to Fork Strategy, which require alignment between EU-level objectives and local implementation capabilities[118]. The coordination of the Common Agricultural Policy (CAP) strategic plan with local agroecological practices demonstrates how MLG balances trade-offs between climate goals, food security, and rural livelihoods. Similarly, tools such as the EU taxonomy, the RRF, and the EU Investment Program include green and social conditions, and national and regional authorities must translate these conditions into projects suitable for local conditions[119].

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[111] Corfee-Morlot, J., Kamal-Chaoui, L., Donovan, M. G. et al. (2009). Cities, climate change and multilevel governance (OECD Environmental Working Papers No. 14). OECD Publishing, https://www.oecd.org/en/publications/cities-climate-change-and-multilevel-governance_220062444715.html; Sovacool, B. K., Martiskainen, M., Hook, A. et al. (2019). Decarbonization and its discontents: A critical energy justice perspective on four low-carbon transitions. Climatic Change 155, 4, 581–619. https://doi.org/10.1007/s10584-019-02521-7; Munta, M. (2020). The European Green Deal: A game changer or simply a buzzword? Friedrich Ebert Siftung, https://doi.org/10.13140/RG.2.2.26393.44645

[112] Bornemann, B., Christen, M., & Burger, P. (2025); Bunea, A., & Nørbech, I. (2023); Council of Europe. (2023). Report on multilevel governance [CDDG(2023)12]. Strasbourg: Directorate General of Democracy and Human Dignity.

[113] European Committee of the Regions. (2024). Towards a multilevel Green Deal governance: the revision of the Governance of the Energy Union and Climate Action Regulation. Brussels: European Committee of the Regions, https://cor.europa.eu/en/our-work/opinions/cdr-0903-2023 ; von Malmborg, F., Björklund, M., & Nordensvärd, J. (2022).

[114] European Commission (2019). The European Green Deal; European Commission (2021). European Climate Law; European Commission. (2022). REPowerEU Plan.

[115] European Commission (2022). REPowerEU Plan; European Commission (2023). Just Transition Mechanism; Maucorps, A., Römisch, R., Schwab, T., & et al. (2023); Kovacic, Z., García Casañas, C., et al. (2024).

[116] European Commission. (2023). Social Climate Fund; European Union (2021). Regulation (EU) 2021/241 establishing the Recovery and Resilience Facility; European Commission (2023). Just Transition Mechanism.

[117] Petelin, E. (2025). Deconstructing Security Discourse in Circular Economy Governance: Towards an Inclusive Approach to Circular Transformation, https://portal.research.lu.se/en/publications/deconstructing-security-discourse-in-circular-economy-governance-/; Sovacool, B. K., Martiskainen, M., Hook, A. et al. (2019); Munta, M. (2020).

[118] Muñoz de Bustillo Llorente, R. (2024); European Commission (2020). Circular Economy Action Plan; European Commission. (2023). Just Transition Mechanism.

[119] European Commission (2020). Circular Economy Action Plan; European Union (2021). Regulation (EU) 2021/241 establishing the Recovery and Resilience Facility.; Maucorps, A., Römisch, R., Schwab, T. et al. (2023).

The success of the EU's clean and sustainable economy policies – which encompass initiatives such as the EGD, CEAP, Farm to Fork, NZIA, CBAM, ETS reform, zero pollution, and biodiversity strategies – depends less on a surge of new targets and more on the robustness of MLG structures and practices[120]. When coordination mechanisms, participatory governance, and regionally equitable arrangements are functioning effectively, MLG can translate EU sectoral strategies into regionally differentiated pathways, thereby balancing climate benefits, social equity, and democratic legitimacy[121]. Conversely, where institutional capacity and coordination remain weak, MLG may inadvertently exacerbate fragmentation, implementation gaps, and distributive conflicts[122].

[120] Bornemann, B., Christen, M., & Burger, P. (2024); Kovacic, Z., García Casañas, C., Argüelles, L. et al. (2024); Niet, I. (2024).

[121] Green European Foundation (2024). Boosting participation in the energy transition: Five action areas for the new EU policy cycle, https://gef.eu/publication/boosting-participation-in-the-energy-transition-five-action-areas-for-the-new-eu-policy-cycle/; European Committee of the Regions (2024). Towards a multilevel Green Deal governance: the revision of the Governance of the Energy Union and Climate Action Regulation. Brussels: European Committee of the Regions, https://cor.europa.eu/en/our-work/opinions/cdr-0903-2023

[122] Maucorps, A., Römisch, R., Schwab, T. et al. (2023); von Malmborg, F., Björklund, M., & Nordensvärd, J. (2022); European Commission (2023). A Green Deal Industrial Plan for the Net-Zero Age.

4. Sustainable and Smart Mobility

Sustainable and smart mobility is a central pillar of the EGD. The transport sector is responsible for a significant share of GHG emissions and, at the same time, represents a growing environmental and health burden. Mobility is not understood as an isolated policy field, but as a fundamental prerequisite for a modern, competitive, and socially just economy. Twin just transition includes expanding sustainable modes of transport such as rail and inland waterways, promoting zero-emission vehicles, and strengthening public and active transport. The goal is mobility that is not only climate-friendly, affordable, and accessible to all people, but also secures Europe's long-term competitiveness[123].

By 2030, at least 30 million zero-emission vehicles are expected to be on Europe's roads, while 100 European cities are to achieve climate neutrality. High-speed rail traffic is to double by then, and scheduled services on routes under 500 kilometres within the EU are to operate fully CO_2-neutral. In addition, automated mobility is expected to be deployed on a large scale, and zero-emission ships are anticipated to reach market maturity[124]. By 2035, these advances are to be complemented by the market readiness of zero-emission large aircraft, enabling the aviation sector to make a decisive contribution to decarbonisation as well. The long-term goal for 2050 is an almost complete transformation of the European transport system: nearly all passenger cars, vans, buses, and new trucks are to operate with zero emissions. Rail freight transport is to double by then, while high-speed rail traffic is to be tripled compared to today. In addition, the trans-European transport network (TEN-T), equipped with high-speed connectivity and multimodal solutions, is to be fully operational across the entire network. The EU must carefully consider how new policies are layered onto existing structures and to what extent old structures are completely replaced by new ones [125]. Success will depend largely on whether these measures can be integrated in a way that minimises disruption to existing mobility systems.

4.1 Key Strategic Documents and Core Legislative Guidelines

The EGD supports multimodal transport to make the European transport system more efficient and sustainable. Special priority is given to redirecting a large part of inland freight transport towards rail and inland waterways[126]. The resumption of work on the Single European Sky is presented as a decisive step to reduce emissions and increase the efficiency of the European air transport system. Multimodality is intended not only to improve freight transport but also to set new standards in passenger transport. By 2030, the EU aims to offer carbon-neutral options on routes under 500 km and to strengthen cross-border rail services through pilot projects and night trains. Cities are to develop their own mobility plans that integrate cycling, pedestrian infrastructure, and digital mobility services ("mobility as a service"; MaaS). The multimodal transition thus enhances not only sustainability but also the social participation of European citizens[127].

The Commission proposes a series of changes to better reflect the external costs of transport. It wants to abolish subsidies for fossil fuels; tax exemptions on aviation and shipping fuels are to be abolished or reduced to close tax loopholes. The Commission also proposes extending the ETS

[123] European Commission. (2019). The European Green Deal.
[124] European Commission. (2020). Strategie für nachhaltige und intelligente Mobilität: Den Verkehr in Europa auf Zukunftskurs bringen (COM(2020) 789 final) Brüssel: Europäische Kommission. https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX:52020DC0789.
[125] Kern, F. & Howlett, M. (2009). Implementing transition management as policy reforms: A case study of the Dutch energy sector. Policy Sciences 42, 4, 391–408, https://doi.org/10.1007/s11077-009-9099-x.
[126] European Commission. (2019). The European Green Deal.
[127] European Commission. (2020). Strategie für nachhaltige und intelligente Mobilität.



to maritime transport and allocating fewer free certificates to airlines. New political considerations are needed to achieve effective road user charges in the EU[128]. The production and distribution of sustainable alternative fuels is central. The Commission therefore supports the establishment of charging infrastructure especially in gap areas (long-distance transport, sparsely populated regions). However, not only the number of charging stations but also the charging power are central to electric vehicles[129]. It plays a decisive role in how practical and attractive electromobility is perceived in everyday life. Charging points with more than 50 kW are particularly attractive to consumers, as they allow for shorter charging times. The Commission is considering binding minimum shares or quotas for renewable and low-carbon fuels to accelerate their use. In addition, the Commission examines legislative options to promote the production and use of these fuels for all modes of transport[130].

Road transport accounts for around 12 % of the EU's total GHG emissions[131]. While other economic sectors have significantly reduced their emissions, transport sector emissions increased by 21 % between 1990 and 2018. It is therefore the Commission's aim to make the transport sector fundamentally more environmentally friendly and sustainable, especially in cities. Stricter limits for combustion engines, new CO_2 standards, and the inclusion of road transport in emissions trading are planned. In maritime transport, the ship's emission are the objective of new regulations, while at airports, air quality is to be improved through stricter emission limits[132]. The EU relies on initiatives such as FuelEU Maritime and ReFuelEU Aviation aiming to systematically promote the sustainable production and increased use of climate-friendly fuels in maritime and air transport[133].

In the communication "Towards a green, digital and resilient economy: Our European growth model", sustainable and smart mobility is highlighted as a central component of the EGD and as a key factor for economic and social transformation. The pandemic and geopolitical crises have revealed the vulnerability of supply chains and the transport sector, which is why the EU wants to accelerate the transition to sustainable, smart mobility[134]. The goal remains to reduce costs, decrease dependence on fossil imports, and at the same time create new opportunities for employment and innovation. To safeguard the functioning of the European transport system in the face of pandemic and crisis related disruptions, the Commission developed a comprehensive contingency plan in 2022[135]. The Commission quantifies the additional annual investment needs for the transport sector at around €175 billion[136]. This sum is a part of the total of 390 billion euros earmarked for decarbonization, in particular the energy sector[137]. On the supply side, the focus is on expanding renewable capacities, storage solutions, power grids, and above all, charging infrastructure for electric vehicles as well as refuelling stations for alternative fuels such as

[128] European Commission. (2019). The European Green Deal, pp. 10-11-
[129] Falchetta, G., & Noussan, M. (2021). Electric vehicle charging network in Europe: An accessibility and deployment trends analysis. Transportation Research Part D: Transport and Environment, 94, 102813, https://doi.org/10.1016/j.trd.2021.102813
[130] European Commission. (2019). The European Green Deal, p. 11.
[131] Haas, T., & Sander, H. (2020). Decarbonizing transport in the European Union: Emission performance standards and the perspectives for a European Green Deal. Sustainability, 12, 20, 8381, https://doi.org/10.3390/su12208381.
[132] European Commission. (2019). The European Green Deal, p. 11.
[133] Gruber, M. (2021). ReFuelEU Aviation & FuelEU Maritime: Emissionsreduktion im Flug- und Schiffsverkehr. Wien Energie Positionen, https://positionen.wienenergie.at/blog/refuel-eu/.
[134] European Commission. (2022). Towards a green, digital and resilient economy – our European Growth Model. COM(2022) 83 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022DC0083.
[135] European Commission. (2022) A contingency plan for transport (COM(2022) 211 final). (p. 1). Brussels: European Commission, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:211:FIN
[136] European Commission. (2022). Towards a green, digital and resilient economy, p. 5.
[137] Ibid.



hydrogen. On the demand side, the focus is on energy-efficient building renovations, decarbonizing industry, and developing infrastructure for sustainable mobility[138].

Achieving the European climate-neutrality targets in the transport sector is considerably more difficult for member states such as Bulgaria, Romania, Hungary, Croatia, Slovakia, and Slovenia than for wealthier ones[139]. In these countries, road transport (with its high CO_2 emissions) dominates, while rail and inland waterways account for only a small share of freight and passenger transport. Alternative fuels are still scarcely used, and the digital infrastructure for multimodal mobility remains incomplete. These structural deficits significantly hinder the shift towards a climate-neutral transport system and underline that the EU's objectives can only be achieved through targeted financial support and infrastructure investments. The EU must allocate its investments strategically to ensure that structurally weaker countries do not fall behind and that the sustainable transformation of the entire European transport sector succeeds.

The communication discursively links mobility with security of supply and resilience. Electrification and efficiency measures in transport are intended not only to reduce emissions but also to decrease dependence on oil and gas imports. At the same time, mobility is presented as a driver of innovation. New business models in the circular economy, digitalisation of traffic flows, smart mobility, and AI-supported control systems are intended to strengthen the EU's competitiveness[140]. The social dimension is particularly emphasised. The transition must "put people first" and ensure that no one is left behind[141]. Overall, the communication frames sustainable and smart mobility as a strategic lever for decarbonization, energy security, and social fairness. It connects climate goals with economic competitiveness and positions mobility as part of the EU's "strategic autonomy".

The factsheet[142] summarises this document's contents and lists the EU's central priorities. These are the implementation of the EGD, the exploitation of opportunities in Europe's Digital Decade, and the strengthening of resilience and crisis preparedness. Particular emphasis is placed on reducing dependence on imported fossil fuels, thereby "improving the Union's energy and resource security"[143]. The urgency for Europe to intensify its focus on sustainable fuels, driven in part by the need for strategic independence, is underscored by the fact that, as recently as 2021, 94% of the energy consumed by the transport sector was derived from petroleum, 84% of which was imported from third countries[144]. This creates a dual challenge: on the one hand, it renders the European transport sector vulnerable to the geopolitical situation in these non-EU countries; on the other hand, the continued use of such vast quantities of fossil fuels is fundamentally incompatible with sustainability objectives. The factsheet also refers to the digital transformation of the EU, accelerated by the coronavirus pandemic, which also affects the mobility sector and is intended to contribute to more sustainable, user-friendly transport[145]. It is also emphasised that stable, resilient supply chains are crucial, especially in times of crisis. As in other areas, the need for redistribution of the workforce is also emphasized in the mobility sector, and more efficient administration is to be created[146].

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[138] Ibid.
[139] Koralova-Nozharova, P. (2021) European Green Deal and transport sector development – opportunities or restrictions. SHS Web of Conferences, 120, 04004, https://doi.org /10.1051/ shsconf/ 202 11 2 004004.
[140] European Commission. (2022). Towards a green, digital and resilient economy, pp. 5-6.
[141] Ibid.
[142] European Commission. (2022). Towards a green, digital and resilient economy: Our European Growth Model [Factsheet]. Brussels: European Commission, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_22_1467/IP_22_1467_EN.pdf.
[143] Ibid.
[144] Koralova-Nozharova, P. (2021).
[145] European Commission. (2022). Towards a green, digital and resilient economy.
[146] Ibid.

4.2 Obstacles and Limitations

A central structural obstacle is the absence of a central political authority capable of translating the framework conditions into coordinated, decisive action[147]. The EU often acts merely as a rule-setter, lacking sufficient executive powers, which complicates implementation at the national level. Since sustainable mobility falls within the national competence of the member states, unavoidable conflicts of interest arise between them. While wealthier countries can advance the transition more quickly, others struggle with strict budgetary constraints, older vehicle fleets, and greater dependence on fossil fuels. Thus, while the states are moving forward, they do so at very different speeds. Under these circumstances, a completely uniform fulfilment of the targets by 2050 appears doubtful[148].

Many funding instruments remain tied to expanding the road network[149], to eliminate congestion or bottlenecks. This makes car travel more attractive and increases traffic volumes, while simultaneously leaving fewer resources for rail, public transport, or cycling infrastructure. The existing financing mechanisms thus reinforce the prevailing car-oriented system. It is therefore necessary to fundamentally reform the existing financing and planning systems[150]. Different stakeholder groups hold very different views on how decarbonisation in the European transport system should be achieved[151]. Business and industry often rely on technological solutions, particularly the electrification of vehicle fleets. While this strategy reduces the emissions of individual vehicles, it does not change the underlying car-centred transport system. Conversely, many cities call for a fundamental change in behaviour, a modal shift towards active mobility and public transport. These approaches, however, regularly encounter resistance from local economic actors who expect financial disadvantages as a result[152]. Another major obstacle to sustainable mobility lies in the lack of public acceptance[153]. Sustainable mobility, therefore, requires not only technical solutions but, above all, a participatory process that builds trust and brings about long-term changes in attitudes toward transport.

4.3 Connection with Multi-level Governance

MLG does not only mean that responsibilities are distributed across EU, national, regional, and local levels, but also that these levels must communicate continuously and coordinate their decisions[154]. In the field of sustainable and smart mobility in particular, it becomes clear that goals can only be achieved when all levels act in a clear, transparent, and mutually supportive manner. This occurs, for example, when EU requirements for expanding charging infrastructure are

[147] Meroni, F. (2025). From ambition to implementation: Europe's sustainable mobility challenge. ORF Middle East. https://www.orfonline.org/research/from-ambition-to-implementation-europe-s-sustainable-mobility-challenge.
[148] Schemmel, J. P. (2019). Der „Green Deal" der EU: realistisch oder nicht? Öko-Institut, https://www.oeko.de/blog/der-green-deal-der-eu-realistisch-oder-nicht/.
[149] Colombo, C. M., & Dijk, M. (2023). Understanding the policy integration challenges of sustainable urban mobility in the context of rapid decarbonisation. European Journal of Risk Regulation 14, 3, 585–599).
[150] Kapeller, J., Porak, L., & Schütz, B. (2025). Transnationaler Schienenausbau in Europa – Hindernisse, Kosten und ökonomische Effekte. Institut für Sozioökonomie, Universität Duisburg-Essen. https://www.uni-due.de/imperia/md/content/sozioookonomie/ifsoexp30_kps2025_schienenbau.pdf.
[151] Colombo, C. M., & Dijk, M. (2023).
[152] Plehwe, D., Neujeffski, M., & Haas, T. (2024). Climate Obstruction in the European Union: Business Coalitions and the Technocracy of Delay. Oxford University Press.
[153] Banister, D. (2008). The sustainable mobility paradigm. Transport Policy 15, 2, 70-78.
[154] European Commission. (2020). Urban Agenda for the EU – Partnership for Urban Mobility. Reinforcing multi-level cooperation and governance, https://ec.europa.eu/futurium/en/system/files/ged/ua_pum_-_action_1_reinforcing_multi-level_cooperation_and_governance_-_final_report.pdf.

translated into national funding programmes and ultimately into concrete local projects, such as new fast-charging stations in residential areas[155].

Effective implementation first requires functioning vertical communication. The EU sets long-term goals, legislation, and funding programmes, for example, the objective of doubling high-speed rail traffic by 2030 or putting 30 million zero-emission vehicles on the road[156]. These requirements must be understood by the member states and translated into national strategies, for example, through national electromobility laws. At the same time, the cities and regions that implement the mobility transition on the ground need to feed their experiences and needs back to the higher levels[157]. This happens, for instance, when cities such as Amsterdam or Copenhagen report that the expansion of cycling lanes is progressing more quickly than the development of secure bicycle-parking facilities[158], or when smaller municipalities point out that they cannot procure zero-emission bus fleets without additional funding[159]. Only if these feedback signals are taken seriously can the EU adjust its policies to realistic conditions.

In addition to this vertical coordination, horizontal cooperation is equally important. At the EU level, this includes various directorates-general, at the national level, ministries and agencies, and at the local level, transport authorities, urban-planning departments, businesses, and civil-society groups. To avoid potential conflicts, stable communication structures are needed, such as joint working groups, coordinated planning processes, or shared data platforms[160]. A particularly effective and often overlooked opportunity for direct exchange between municipalities is city twinning. This horizontal exchange enables cities to share their experiences, for example, in expanding cycling infrastructure, introducing new bus routes, or designing traffic-calmed zones[161]. Coordination between different policy fields is another key factor. Mobility policy is closely interconnected with energy, digitalisation, spatial planning, economic policy, and social policy. If these areas are not aligned and do not cooperate, delays or ineffective measures are likely to occur[162].

For this cooperation to function, trust is essential. Political levels must communicate openly with one another, clearly define responsibilities, and adhere to reliable timelines. Especially in the field of mobility, which affects people's everyday lives, trust is crucial for creating acceptance of change. Many people lose trust in public transport when it is unreliable[163]. The EU must set guidelines that take local capacities into account; member states must design funding instruments that municipalities can actually use; cities must clearly articulate their needs; and regions must act as intermediaries between the local and national levels. When these elements interlock, a coherent and capable multilevel system emerges, one that can genuinely achieve the ambitious

[155] Nationale Leitstelle Ladeinfrastruktur. (n.d.). Ladeinfrastruktur im EU-Kontext. https://nationale-leitstelle.de/ladeinfrastruktur-im-eu-kontext/.
[156] European Commission. (2019). The European Green Deal, p. 10.
[157] European Commission. (2020). Urban Agenda for the EU – Partnership for Urban Mobility, p. 5.
[158] European Cyclists' Federation. (2023). Cycle parking – Infrastructure and services, https://handshakecycling.eu/solutions/cycle-parking#AMS10AMS18.
[159] Agentur für Erneuerbare Energien. (2025). Bundesverkehrsministerium fördert die Umstellung von Busflotten auf klimafreundliche Antriebe. https://www.unendlich-viel-energie.de/themen/verkehr/bundesverkehrsministerium-foerdert-die-umstellung-von-busflotten-auf-klimafreundliche-antriebe.
[160] European Commission. (2020). Urban Agenda for the EU – Partnership for Urban Mobility, pp. 4-5.
[161] Ellena, S. (2023). City pairings across Europe and beyond. Euractiv. https://www.euractiv.com/news/city-pairings-across-europe-and-beyond/.
[162] Leinauer, C., Wagon, F., & Strüker, J. (2024). Leveraging twin transformation: Digital infrastructures to advance decarbonisation at the nexus of energy and mobility. Fraunhofer Institute for Applied Information Technology FIT. https://digital-strategy.ec.europa.eu/en/news/accelerating-green-transition-role-digital-infrastructures-decarbonising-energy-and-mobility.
[163] Soza-Parra, J., Raveau, S., & Muñoz, J. C. (2022). Public transport reliability across preferences, modes, and space. Transportation 49, 621–640, https://doi.org/10.1007/s11116-021-10188-2

goals of the EGD. MLG is, in this sense, a learning process[164]. The different political levels do not master their cooperation perfectly from the outset; rather, they improve it step by step. Over time, EU institutions, member states, regions, and municipalities accumulate experience in planning, financing, and implementing mobility projects, and in exchanging information, problems, and solutions across levels. Through this continuous interaction, the levels learn to optimise their coordination processes, avoid misunderstandings, and achieve shared goals more efficiently.

[164] Williams, S., Holmén, J., & Holmberg, J. (2024). Multi-level learning for systemic transformation: Experiences from an expedition in North Mid Sweden. Environmental Science & Policy 156, 103740.

5. Research and innovation

Innovation aimed at improving the EU's energy and climate policy is not limited to the EGD. Also, the Commission's previous initiatives argued that innovation and research are crucial to the competitiveness of the EU economy, in general and industry in particular. Energy Union, the most complex initiative of the 2010s prior to EGD, consisted of five main pillars, with "Research, innovation and competitiveness" being the last one[165]. While the Energy Union was originally focused primarily on energy security, the Commission turned it into a complex policy with many dimensions, including decarbonisation. Therefore, there was strong emphasis on renewable energy sources and their future role in the decarbonised EU.

The starting point of the Energy Union initiative was that although the EU is "still leader in innovation and renewable energy" […] "other parts of the world are fast catching up and [the EU] ha[s] already lost ground when it comes to some clean, low carbon technologies"[166]. Therefore, the Energy Union argued, the EU needs a new strategy for research and innovation. Innovation was supposed to be visible, especially in renewables, smart technologies, clean transport, clean fossil fuels, and safe nuclear technology. The Energy Union argued that the fragmentation of various support programmes limits the effectiveness of funds for research and innovation, and therefore synergies must be achieved to "get the maximum possible results from every Euro invested across the whole EU"[167].

Four core priorities in this area for Energy Union were as follows: a) creation of the next generation renewable energy technology; b) development of smart technologies; c) increase energy efficiency, especially in buildings; d) a more sustainable transport system. More than 10 years after the adoption of the Energy Union, we can claim that these goals were met only partially, if at all. The innovation-driven transition towards a carbon-neutral economy "offers great opportunities for growth and jobs" and "the EU industry [will] benefit from the first-mover advantage, both domestically and within international technology markets"[168]. Fifteen action points of the Energy Union claimed that "the EU needs to develop a forward-looking, energy and climate-related R&I strategy to maintain European technological leadership and expand export opportunities"[169].

To achieve goals set within Energy Union, especially those where member states were supposed to contribute to a common achievement without binding national goals, the EU adopted Governance Regulation 2018/1999[170]. Issues connected to innovations and research were a crucial part of this document. When member states were asked by the Regulation to develop their National Energy and Climate Plans (NECPs), these were supposed to be structured according to the five main dimensions of Energy Union, including "Research, innovation and competitiveness". Therefore, the Regulation stated that the NECPs should include "national objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union", including a deadline[171]. The innovation the Regulation was especially interested in was in the area of "clean energy technologies" (for example, Article 25 of the Regulation). The Regulation

[165] European Commission. (2015). A framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0080.
[166] Ibid., p. 3.
[167] Ibid, p. 16.
[168] Iid, p. 17.
[169] Ibid., p. 21.
[170] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999
[171] Ibid., p.3.



asked member states to report every two years on their progress in fulfilling the goals set out in their NECPs, including those related to research and innovation.

5.1 Key Strategic Documents and Core Legislative Guidelines

The EGD also discusses extensively issues related to research and innovation, especially in section 2.2.3, "Mobilising research and fostering innovation". However, innovations (interlinked with research) should be part of efforts in several concrete sub-areas of energy policy – including energy efficiency (housing), developing strategic value chains (rare earths), and alternatives to the currently existing hazardous chemicals or "techniques to improve the sustainability of the food system, while ensuring that they are safe"[172]. Innovations are also a tool (among others) to ensure that EGD achieves its goals without negatively affecting the Union's economic, environmental, and social objectives. Technological progress is thus viewed as one way to ensure that the impact of decarbonisation efforts envisioned in the EGD is managed and that as few people as possible are on the 'losing side'. Indeed, the EGD argues that "[n]ew technologies, sustainable solutions and disruptive innovation are critical to achieve the objectives of the [EGD]"[173]. Clean technologies are crucial for competition in the post-fossil fuel world, and the EU needs to maintain its position by investing in the development of new technologies that are essential to decarbonisation as a process and to a decarbonised world as its outcome.

Such a goal, however, cannot be achieved by individual member states as it requires cooperation. Therefore, the EGD proposes that 35% of Horizon Europe and other EU programmes be dedicated to climate research. EGD highlights "innovation on transport, including batteries, clean hydrogen, low-carbon steel making, circular bio-based sectors and the built environment" as the main topic of research and innovation aimed at EU funds. The aim is to support collaboration between higher education institutions, research institutions, and companies on climate change and decarbonisation. Understanding the need for innovation also within the research structures, the document claims that "[c]onventional approaches will not be sufficient"[174], underlying the need for the development of novel ways of research collaboration that can also include previously excluded actors like local communities.

An important dimension of decarbonisation is the existence, availability, and accessibility of data that can support the development of data-driven green policies and decarbonisation. Therefore, the EGD considers the digital transition a key dimension of the success of the green transition and the main reason why, within the DeCrises project, we are looking at both these transitions and their just dimension.

The Commission offers funding to support investigations into EGD-related issues that should lead to innovations that help achieve its goals. The main idea was that this funding would boost EU energy recovery following the COVID-19 pandemic, thereby aligning the original EGD goals with those of the post-pandemic recovery. To date, the most important activity in this direction was the 2020 call within the Horizon 2020 scheme, worth €1 billion to support climate science. Its aim was to "mobilis[e] the EU research and innovation community to develop solutions that respond to the climate crisis, reduce GHG emissions, provide more protection to Europe's biodiversity and habitats under threat, and accelerate a sustainable socio-economic recovery, leaving no one

[172] European Commission. (2019). European Green Deal, p. 19.
[173] Ibid, p. 18.
[174] Ibid.



behind"[175]. The call attracted 1550 proposals out of which 73 were financed, the call "sought to demonstrate the key ability of [research and innovations] to provide concrete solutions within a relatively short time frame"[176].

Therefore, the 2020 Horizon call adopted an 'impact-focused approach'. At the same time, the just dimension of the EGD demanded that the supported project would ensure their suggested solutions would 'leave nobody behind'. The "Empowering citizens for the transition towards a climate-neutral, sustainable Europe" thematic area of the call attracted the most proposals, with 373 altogether (almost 25% of all submissions). The selected projects were supposed to help the EU address the climate crisis and protect its biodiversity and unique ecosystems[177]. The Green Deal Projects Support Office was created to support the implementation of projects within this special EGD call. To ensure the Office is as effective as possible, five working groups were created to facilitate cooperation, networking, and knowledge sharing.

Within the current multiannual financial framework (2021-2027), Horizon Europe is the EU's main research and innovation programme. At least 35% of this tool is assigned to the project addressing climate change and related issues. To support the development of new ideas and innovations, Horizon Europe exists alongside other EU programmes and includes research and innovation partnerships (so-called 'green' partnerships). These partnerships are supposed to help transform economies and societies in ways that support decarbonisation and reach the goals of the EGD. The most important areas of research include transport, built environment, and biodiversity[178].

Although the Innovation Fund has already been established for more than two decades, we are discussing it after EGD due to its very close connection to the Fit for 55 initiative, which stems from EGD. The Innovation Fund was established in 2003 together with the ETS (Directive 2003/87/EC)[179] "to support innovative low-carbon technology demonstration projects in energy-intensive industry, renewable energy, energy storage, carbon capture, use (CCU) or storage (CCS)"[180]. The main characteristics of projects supported by the Innovation Fund are that they support, in one way or another, the decarbonisation of the EU's economy. The fund is supposed to complement other tools supporting research and innovation, such as the Horizon scheme. ETS was revised in 2018 (Directive (EU) 2018/410), and so was the Innovation Fund. The main change in the ETS revision in connection with the Innovation fund was an increase in the financial support available through the fund, as well as the maximum funding rate to 60% of relevant costs.

Funds provided are linked to projects' ability to reduce GHG emissions; in the original system, this rule applied to the full amount of granted support; after the 2018 ETS revision, 40% of support is not tied to the project's ability to avoid emissions. However, examination of the supported

[175] European Commission. (2026). Green Deal Projects Support Office. https://projects.research-and-innovation.ec.europa.eu/en/strategy/strategy-2020-2024/environment-and-climate/european-green-deal/green-deal-projects-support.

[176] European Commission. (2026). The European Green Deal Call for proposal in Horizon 2020, https://op.europa.eu/en/publication-detail/-/publication/a44918ee-62d6-11ec-a033-01aa75ed71a1/language-en, p.4.

[177]European Commission. (2026). Research and innovation for the European Green Deal. https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/environment-and-climate/european-green-deal_en.

[178]European Commission. (2026). European Partnerships in Horizon Europe. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe_en.

[179] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0087.

[180] European Commission. (2019). Commission Staff Working Document Impact Assessment. SWD(2019) 85 final. https://climate.ec.europa.eu/document/download/3bf59a7c-cc7e-4d25-bf06-3d7ad90c6775en?Filename =swd_2019_85_en.pdf,

projects showed that many projects have difficulty reaching their goals, resulting in withdrawal from the programme. For example, 7 out of 13 bioenergy projects selected for financing in the 2012-2014 period were withdrawn by 2018, and at the same time, no carbon capture and storage projects were implemented.

In 2022, the Commission published a communication entitled "Towards a green, digital and resilient economy: our European Growth Model," which focused on the twin transition and is thus closely connected to EGD[181]. This document reflected on "rapidly worsening geopolitical context" that requires to "reinforce [EU's] long-term sustainable growth agenda"[182]. The document states that the European growth model is green and digital, enabling competitive sustainability. It also argues that these two dimensions are the crucial ones and therefore there is a need for transition that includes these dimensions: "The shift towards a sustainable, resilient and inclusive economic model, enabled by a broader diffusion and uptake of digital and green technologies and skills, will help address key challenges Europe faces, improve its position as a global leader and strengthen its open strategic autonomy"[183]. This is especially important nowadays, the European Growth Model argues, given the new challenges that have emerged after the Russian invasion of Ukraine.

The transformation of the EU's economy relies on two pillars: investments and reforms. The latter is linked to innovation and research. According to this document, innovations are also necessary to improve the EU's energy security. The EU established a programme focused on supporting research and innovations entitled the Important Projects of Common European Interest, to support research and innovation. While it mimics the Projects of Common Interest established in the energy area, these projects have been predominantly focused on microelectronics and connectivity, although projects on hydrogen and batteries (closely related to energy policy) were also financed.

Following the Russian invasion of Ukraine in February 2022, the EU adopted the REPowerEU strategy to reduce its dependence on Russian energy sources and strengthen domestic renewable energy supplies. The invasion highlighted "the EU's over-dependence on gas, oil and coal imports from Russia", and EU leaders therefore agreed to phase out Russian energy sources as soon as possible. The way REPowerEU suggests doing this is "by fast forwarding the clean transition and joining forces to achieve a more resilient energy system and a true Energy Union"[184]. Innovation should be a key factor in these processes: it should foster the deployment of new renewables and support breakthrough technologies linked to renewable energy sources.

5.2 Obstacles and Limitations

While the EU is dedicating large sums to research and innovation, existing systems still suffer from several shortcomings, linked to both the internal EU level and the international arena. First, there are general challenges in research and innovation across the EU. Low innovation potential within the EU is often cited as one of the biggest problems in the EU's economy, with the focus on the lack of innovation, especially in relation to renewable energy sources. The experience with photovoltaic technology in the late 2000s and early 2010s is often cited as an unsuccessful effort to achieve global technological leadership. The EU lost its head start to China for various reasons, some of which were connected to issues unrelated to EU's innovation potential. Still, the EU tried to learn its lesson from this experience. Although the EU has a large internal market with four

[181] European Commission. (2022). Towards a green, digital and resilient economy: our European Growth Model.
[182] Ibid., p.2.
[183] Ibid.
[184] Ibid., p.1.



main freedoms enabling workers (including talent) to move freely across the whole EU, low mobility remains an issue within the EU.

There are still differences between educational systems of EU member states, and most of the integration in education policy has happened in an informal setting (so-called Open Method of Cooperation – for example, Erasmus programme or the Bologna process). EU research and education institutions are still not very interesting for international talent, as US institutions dominate the ratings. This situation has worsened after the UK left the EU, as its educational system is considered to be among the top. Although we have seen the arrival of US researchers to the EU member countries recently due to deteriorating research conditions within the US, the number of researchers has been modest.

The innovative potential of the EU is challenged by other main actors, especially the US, but also China and other large players. It is, however, crucial for the EU to become the leader in innovations, especially those connected to decarbonization and renewable energy sources. For both domestic and international reasons. The EU does not have any significant fossil fuel resources and thus depends on imports from third countries, an issue that negatively affects its energy security (see Section 2 for more details). The 2026 Middle East energy crisis caused by the US/Israeli attack on Iran and its retaliation highlighted once again the EU's dependency on external fossil energy supplies. Renewable energy sources have been highlighted as a solution to the EU's long-term energy challenges by many actors, including the Commission and many member states. However, more innovations are needed to fully integrate renewables into the EU energy mix and to turn them into a solid basis for the EU's energy system. From an international perspective, innovation in decarbonisation is necessary for the EU to establish a regulatory framework and set the pace of renewable development. This can turn the EU into a renewables powerhouse able to export its know-how abroad and, in that way, strengthen its economic (and thus also political) position in the international arena. This is something the EU needs, given its current global instability and sudden, unpredictable changes. It will enable the EU to gain a competitive advantage in the post-fossil fuels global economy that is being developed, and the pace of such development is currently increased by consecutive crises that impact fossil fuels, their availability, as well as price.

5.3 Connection with Multi-level Governance

When compared to other examined sectors of the economy (for example, mobility), research and innovation are somewhat specific in the level at which they are implemented. The majority of research activities are taking place at the level of member states, although a significant amount of funding is provided by the EU through various grant schemes – including those targeting academic research, applied research, and innovation. Another specificity of this field is tied to the source of funding – much research and innovation is driven by private money within private companies that support their own research and development to increase competitiveness. This is also one of the main challenges within the EU, discussed in the previous part of this section, as well as in other sections of this report – the impact of decarbonization on competitiveness is a crucial issue within the European Union. Many tools aimed at reducing GHG emissions, including ETS, are considered detrimental to the competitiveness of European companies, as they increase the costs of final products by adding 'green' fees. Therefore, the role of the EU fund aimed at research and innovation is to support the development of a low-carbon economy within the EU focused on technologies supporting decarbonisation.

However, this does not mean that the MLG approach is not applicable to research and innovation. On the contrary, it can help us understand (at least partly) the differences between research and innovation across various parts of the EU. There are differences in support for research and

innovation among member states as the support mechanisms are dispersed at both the national and EU levels, and individual member countries dedicate various levels of their GDP to research and innovation. Moreover, there are also differences in the success rates of applications for EU research grants. While some member states have had a very good record, others have been much less successful.

This concerns general research and innovation as well as research and innovations in the decarbonisation area. While the former is important in general, the latter is crucial for the EU’s ability to gain the first-mover advantage in the regulatory area and a competitive advantage (see also the following Section 6). We can clearly see the differences among member states in the results of the European Research Council's (ERC) most prestigious grants – some member states have hosted in almost 20 years of the Council's history only a handful of projects (e.g., Slovakia is an especially alarming case), while other countries are able to attract a high number of grant holders every year[185].

[185] ERC (2026) Projects and statistics. https://erc.europa.eu/projects-statistics.

6. EU as a global leader

EU's role as a global actor in climate and energy transition is a crucial dimension of the EGD, as the drivers and consequences of climate change transcend national borders and require coordinated international action. Understanding what the EU does globally is vital not only because the EU is responsible for setting ambitious domestic targets, but also because its credibility, competitiveness, and long-term decarbonisation prospects depend on its ability to shape global norms, influence third-country policies, and prevent carbon leakage. The EU has adopted an extensive framework of legal instruments and strategic communications that position the bloc as a frontrunner in the global transition toward climate neutrality and sustainable energy systems. This architecture represents an evolution from normative policy statements to legally binding commitments, integrating climate action with economic competitiveness, energy security, and diplomatic engagement. Through its combination of regulatory power, climate diplomacy, trade instruments, financial tools, and strategic partnerships, the EU seeks to project its climate ambition outward and support a global shift towards low-carbon, just, and secure energy systems.

6.1. Key Strategic Documents and Core Legislative Guidelines

In the EGD the EU positions itself as a global leader in climate action by combining ambitious domestic policies with strong international engagement. EU's approach is grounded in promoting the Paris Agreement as the central multilateral framework, intensifying diplomatic efforts through bilateral and multilateral channels, and leveraging trade policy to enforce sustainability commitments. The EU aims to use its economic weight and regulatory standards to influence global value chains, foster green alliances, and support the development of international carbon markets. It prioritises environment, energy, and climate partnerships with major emitters, neighbouring regions, and developing countries, planning to tailor strategies to local contexts while advancing renewable energy and biodiversity initiatives. Financially, the EGD envisages that the EU will channel significant public climate finance and mobilize private investment through instruments like guarantees and blended financing. Furthermore, it leads efforts to create a global sustainable finance system via platforms for taxonomies and standards. By integrating climate considerations into trade, security, and development policies, the EU seeks to drive a just global transition, reduce instability risks, and set international norms for sustainable growth.

The political commitments of the European Green Deal are translated into binding legal obligations through the European Climate Law (Regulation (EU) 2021/1119), which explicitly codifies the EU's intention to act as a global leader:

> "The Union is a global leader in the transition towards climate neutrality, and it is determined to help raise global ambition and to strengthen the global response to climate change, using all tools at its disposal, including climate diplomacy"[186].

The EU Climate Law emphasises that the EU should maintain its climate leadership beyond 2050 to safeguard people and the planet, aligning with the Paris Agreement's long-term temperature goals and scientific assessments from bodies such as the Intergovernmental Panel on Climate Change (IPCC), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the European Scientific Advisory Board on Climate Change (ESABCC). In line with this, in November 2025, the EU member states agreed on a legally binding 2040 target

[186] European Parliament & Council of the European Union. (2021). European Climate Law, Recital 16.

of 90% reduction in net GHG emissions (compared to 1990), with a domestic target of 85% reduction and up to 5% from international carbon credits[187].

A central instrument in the EU's external climate strategy is the Carbon Border Adjustment Mechanism (Regulation (EU) 2023/956), which entered into force on October 1, 2023. The Climate Law explicitly identifies carbon leakage risks with international partners who do not share the EU's climate standards, thereby justifying the creation of CBAM as a mechanism compatible with WTO rules[188]. CBAM[189] operates through a declarative system in which authorised declarants report annually the quantity of imported goods and their embedded emissions and surrender CBAM certificates priced in line with EU ETS allowances. Implementation included a transitional reporting phase (2023–2025), followed by full obligations from 2026, with certificates sold via a central platform and compliance monitored through a CBAM registry. Recent amendments introduce simplifications, including a single mass-based threshold of 50 tonnes per year for de minimis exemptions, streamlined verification rules, default values for emissions when actual data is unavailable, and mechanisms to adjust thresholds and fees via delegated acts[190].

The EU External Energy Engagement Strategy (May 2022) established objectives for the EU's global energy policy, including reducing energy demand, boosting renewable energy development, supporting Ukraine, and paving the way for green hydrogen partnerships[191]. The strategy focuses on building long-term partnerships that combine short-term diversification with long-term decarbonization. In the immediate term, the EU seeks additional LNG and pipeline gas from trusted suppliers such as the US, Norway, Algeria, and Azerbaijan, while promoting methane reduction schemes. Simultaneously, it is laying the foundations for global hydrogen trade through strategic partnerships in the Mediterranean, Africa, and Ukraine, and by promoting common standards and certification for a transparent hydrogen market. The EU also supports partner countries in their green transition via the Global Gateway initiative, mobilizing funding for sustainable infrastructure, and through climate finance commitments, just transition partnerships, and technology cooperation. The EU External Energy Engagement Strategy envisages deploying energy diplomacy through multilateral fora such as the G7, G20, IEA, and IRENA, while reinforcing bilateral ties with key regions including Africa, the Gulf, and Asia. Trade policy and raw material partnerships are planned to secure critical inputs for clean technologies and avoid new dependencies.

The EU's Global Gateway initiative aims to mobilise up to €300 billion between 2021 and 2027 to close the global infrastructure investment gap and advance sustainable development[192]. Its targets focus on building high-quality, climate-neutral, and inclusive infrastructure in key sectors such as digital connectivity, clean energy, transport, health, and education, while promoting democratic values, transparency, and equal partnerships. Implementation relies on a Team Europe approach combining EU institutions, member states, and private actors, supported by

[187] Council of the European Union. (2025). 2040 climate target: Council and Parliament agree on a 90% emissions reduction. https://www.consilium.europa.eu/en/press/press-releases/2025/12/10/2040-climate-target-council-and-parliament-agree-on-a-90-emissions-reduction/. The whole policy process was concluded in spring 2026 when Regulation (EU) 2026/667 was formally adopted.

[188] European Parliament & Council of the European Union. (2021). European Climate Law, Recital 18.

[189] European Parliament & Council of the European Union. (2023). Regulation (EU) 2023/956 establishing a carbon border adjustment mechanism, https://eur-lex.europa.eu/eli/reg/2023/956/oj/eng

[190] European Parliament & Council of the European Union. (2025). Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956 as regards simplifying and strengthening the carbon border adjustment mechanism. https://eur-lex.europa.eu/eli/reg/2025/2083/oj/eng

[191] European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2022). EU external energy engagement in a changing world (JOIN(2022) 23 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52022JC0023.

[192] European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2021). The Global Gateway (JOIN(2021) 30 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021JC0030

financial instruments like EFSD+ guarantees and blending facilities to de-risk investments and attract private capital. Complementary measures include regulatory cooperation, technical assistance, and trade agreements to create enabling environments in partner countries, alongside coordination with like-minded partners such as the G7 to maximise global impact.

The Clean Industrial Deal (February 2025) focuses on strengthening Europe's industrial competitiveness while achieving deep decarbonisation. It aims at transforming Europe's industrial base by accelerating decarbonisation, electrification, and clean-tech manufacturing, while ensuring affordable energy, circularity, and strong lead markets for low-carbon products[193]. The EU Global Climate and Energy Vision (October 16, 2025) builds on this internal transformation and projects it outward. It positions the EU as a global leader in the clean transition through diplomacy, trade, and partnerships[194]. It leverages the industrial strengths developed under the Clean Industrial Deal to promote EU technologies abroad, secure critical raw materials, and shape global standards and climate governance. Key targets include tripling global renewable energy capacity and doubling energy efficiency improvements by 2030, as pledged at COP28, and supporting a just transition away from fossil fuels worldwide. Implementation mechanisms involve forging Clean Trade and Investment Partnerships**,** deploying the Global Gateway Strategy to mobilise €300 billion for climate and energy projects, and establishing an EU External Clean Transition Business Council**.** The EU also promotes carbon pricing globally, advances regulatory convergence through Green Alliances, and supports flagship projects in partner countries to scale clean technologies. These external actions are complemented by trade agreements, climate finance commitments, and participation in multilateral fora such as the UNFCCC, G7, and G20, reinforcing the EU's role as a credible and trusted partner in shaping global norms for sustainable growth[195]. The EU's strategic approach to global climate and energy leadership operates through multiple interconnected dimensions that combine regulatory power, diplomatic engagement, financial mobilization, and standard-setting capacity.

The principle of effective multilateralism underlies the EU's diplomatic approach, with the bloc positioning itself as a firm defender of the rules-based international order. The Climate Law establishes the framework specifically to deliver on the Paris Agreement, which is referred to as the 'indispensable multilateral framework' in the EGD[196]. This commitment is operationalized through the Team Europe approach**,** which coordinates diplomatic outreach between EU institutions and member states to present a unified front in climate negotiations.[197] The Council of the EU highlights that the Team Europe approach is central to advancing the EU's climate commitments by enabling coordinated, large-scale action with partner countries.[198] It aligns Team Europe Initiatives and Global Gateway projects with partner countries' development strategies, enhancing the EU's capacity to implement the Paris Agreement, achieve Sustainable Development Goals, and support a social, green, and digital transition through joint programming, financing, and multi-stakeholder coalitions. The EU's diplomatic achievements include the Global Pledge on Renewables and Energy Efficiency**,** launched at COP28 in December 2023, where around 130 world leaders committed to tripling global renewable energy capacity to at least 11

[193] European Commission. (2025). The Clean Industrial Deal: A joint roadmap for competitiveness and decarbonisation (COM(2025) 85 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0085.
[194] European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2025). EU global climate and energy vision: securing Europe's competitive role in world markets and accelerating the clean transition (JOIN(2025) 25 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025JC0025.
[195] Ibid.
[196] European Commission. (2019). The European Green Deal.
[197] European Commission & High Representative. (2025). EU global climate and energy vision.
[198] Council of the European Union. (2023). Team Europe approach: Council conclusions (ST 15684/23). https://data.consilium.europa.eu/doc/document/ST-15684-2023-INIT/en/pdf

terawatts by 2030 and doubling energy efficiency improvements to 4% annually[199], supported by the EU's pledge of €2.3 billion from its budget[200].

The EU leverages its market power as a regulatory instrument to export environmental standards globally. The Single Market's size grants measures like CBAM substantial coercive power to incentivize decarbonization in trading partners. By setting sustainability standards that apply across global value chains, the EU shapes production practices beyond its borders[201]. This regulatory influence extends through the EU Taxonomy, which establishes classification systems that global financial institutions increasingly adopt as benchmarks for sustainable investment.

Legal credibility through binding commitments distinguishes the EU's approach from voluntary pledges common in international climate governance. By enshrining the 2050 climate neutrality objective into binding law, the EU provides investment certainty and signals to international partners that its transition is 'irreversible'[202]. The Governance Regulation enhances this credibility through comprehensive reporting systems on GHG inventories and support to developing countries, enabling the EU to lead by example in UNFCCC negotiations. The establishment of the European Scientific Advisory Board on Climate Change to provide independent scientific advice on EU measures and targets further strengthens the evidence-based legitimacy of EU climate action[203].

The EU champions accelerated renewable energy deployment through global pledges and bilateral partnerships. The Global Energy Transition Forum, launched in January 2025, brings together partners including Brazil, Canada, the Democratic Republic of Congo, Kenya, Peru, South Africa, and the United Arab Emirates to deliver flagship projects and unlock investment in clean energy[204]. The EU's strategy includes creating three major hydrogen import corridors via the Mediterranean and the North Sea, and, as soon as conditions allow, via Ukraine, to facilitate the import of 10 million tonnes of renewable hydrogen by 2030, positioning the bloc as a hub for global green hydrogen markets.[205]

Finance and investment mobilization constitute a critical dimension of EU global leadership. The Global Gateway strategy serves as the EU's primary vehicle to support clean transitions globally, aiming to mobilize €300 billion in investments to compete with other geopolitical actors[206]. The EU reaffirms its status as the largest contributor to public climate finance, accounting for €28.5 billion in 2024, while committing to supporting vulnerable countries, particularly Least Developed Countries and Small Island Developing States. Clean Trade and Investment Partnerships (CTIPs) support equitable partnerships with developing countries in energy technology, decarbonization, and access to critical raw materials.

The first-mover regulatory advantage in emerging clean technology markets allows the EU to shape global standards. The bloc has the most advanced regulatory framework for hydrogen and carbon pricing, enabling it to lead efforts to develop global, rules-based markets[207]. By establishing detailed sustainability criteria under RED III for biomass, biofuels, and hydrogen, and

[199] COP28 UAE. (2023, December). Global Renewables and Energy Efficiency Pledge. https://www.cop28.com/en/global-renewables-and-energy-efficiency-pledge
[200] European Commission. (n.d.). EU at COP28 Climate Change Conference, https://commission.europa.eu/topics/climate-action/eu-cop/eu-cop28-climate-change-conference_en
[201] European Commission. (2019). The European Green Deal.
[202] European Parliament & Council of the European Union. (2021). European Climate Law, Art 1.
[203] Ibid, Art 3.
[204] European Commission. (2025, January 22). Europe teams up with partners and launches global forum to accelerate the clean energy transition. https://ec.europa.eu/commission/presscorner/detail/it/ac_25_321
[205] European Commission. (2022). REPowerEU Plan.
[206] European Commission & High Representative. (2022). EU external energy engagement in a changing world.
[207] Ibid.



by imposing comprehensive due diligence requirements arising from various directives, the EU sets benchmarks that global producers must meet to access European markets. Underpinning these strategies is the 'energy efficiency first' principle, codified in both the Climate Law and the Governance Regulation, mandating that efficiency be considered in all planning and investment decisions before new supply capacity is approved[208]. This principle, promoted globally, represents a paradigm shift from supply-side expansion to demand-side management as the foundation of energy security and climate action.

6.2. Obstacles and Limitations

Despite the comprehensive legal framework and ambitious strategic vision, potential gaps between the EU's declared commitments and its capacity to deliver on these goals may undermine the EU's international credibility and leadership position. Scholars identify how the EU engages in 'organised hypocrisy' by maintaining multiple façades – rational, reputational, and progressive – through its talk, decisions, and actions to reconcile conflicting demands from developed and developing countries[209]. While the EU aspires to global leadership in climate diplomacy and promotes itself as a 'green normative power', its actions often diverge from its rhetoric, creating a gap between discourse and practice. Between COP15 and COP21, the EU has shifted from insisting on a legally binding global deal to adopting more flexible, bottom-up approaches, framing climate action as economically beneficial while maintaining normative language for legitimacy and introducing innovation-oriented measures.[210] This approach functions as a tool for adapting to geopolitical realities and sustaining credibility, though it highlights the absence of a fully coordinated climate strategy within the EU's multi-level governance system[211].

The European Scientific Advisory Board on Climate Change (ESABCC) has released a comprehensive report detailing the EU's achievements and challenges in climate and energy transitions. In the implementation of the EU's vision on global leadership, the EU faces several interlinked challenges and limitations:

- There are persistent policy inconsistencies that undermine credibility and effectiveness. EU state aid rules still allow fossil fuel subsidies, and the Energy Taxation Directive continues to tax fossil fuels at a lower rate than electricity. This sends mixed signals to markets and investors, slowing the shift away from carbon-intensive energy sources. Similarly, the Stability and Growth Pact does not differentiate between climate-related investments and other expenditures, thereby limiting fiscal flexibility for green projects[212].
- Policy gaps remain significant in critical areas. There is no structural, long-term EU fiscal capacity beyond temporary instruments like the RRF, nor is there systematic reporting on budget expenditures that violate the 'do no significant harm' principle under the EU Taxonomy. Carbon pricing coverage is incomplete, as agriculture, food systems, and land use are still outside explicit EU-level pricing mechanisms. Furthermore, the EU lacks a clear strategy for preparing carbon markets and sectors for the era of near-zero emissions, including the prospect of allowance supply reaching zero by 2040[213].

[208] European Parliament & Council of the European Union. (2021). European Climate Law, Recital 64.
[209] Çelik, F. B. (2022). The EU's different faces in climate diplomacy: leadership, interests, and responsibilities. Journal of European Integration 44, 8, 1019–1039. https://doi.org/10.1080/07036337.2022.2068538
[210] Ibid.
[211] Ibid.
[212] European Climate Advisory Board. (2024). Towards EU climate neutrality: progress, policy gaps and opportunities. https://climate-advisory-board.europa.eu/reports-and-publications/towards-eu-climate-neutrality-progress-policy-gaps-and-opportunities_en
[213] Ibid.

- Ambition gaps weaken the EU's ability to lead globally. While reforms have strengthened the ETS, free allowances persist for sectors not covered by the CBAM, reducing incentives for deep decarbonization. The design of the new ETS for buildings and road transport (ETS 2) risks falling short of its 2030 targets due to uncertainties around carbon price levels and mechanisms that could loosen the cap. EU policies do not sufficiently stimulate the creation of bankable projects to attract private investment, and initiatives like the Strategic Technologies for Europe Platform remain underfunded compared to the scale of state aid provided to traditional sectors[214].
- Implementation gaps are evident across member states and EU institutions. Few countries have enacted clear laws or timelines for phasing out fossil fuel subsidies, despite repeated commitments. Legislative progress on key measures, such as expanding ETS coverage to extra-EU flights or adopting the revised Energy Taxation Directive, has been slow. Weaknesses in participatory governance and socio-economic impact assessments hinder public support and risk regressive effects, particularly for vulnerable households and regions dependent on fossil fuel industries.[215]
- Structural and systemic barriers exacerbate these limitations. Inadequate infrastructure planning, slow permitting processes, and supply chain vulnerabilities delay the deployment of renewable energy and innovative technologies. Workforce and administrative capacity shortages further constrain the ability to implement climate policies effectively. Combined, these challenges create uncertainty for investors and slow the pace of transition, threatening the EU's ambition to position itself as a global leader in climate and energy transformation[216].

6.3. Connection with Multi-level Governance

The ESABCC report emphasises the fragmented and inconsistent implementation of planning instruments such as National Energy and Climate Plans and Long-term Strategies (LTSs). These tools are intended to provide coherence between short-term and long-term objectives yet delays in submission and persistent deficiencies in analytical depth, scenario transparency, and policy prioritization weaken the EU's capacity to demonstrate credible climate leadership. The problem is not merely one of timing or technical quality. NECPs have increasingly become compliance-oriented reporting instruments rather than strategic governance tools, with participation and coordination requirements often treated as procedural add-ons rather than as drivers of policy learning and ownership.[217]

Local governments – which control many of the decisive levers for decarbonisation – remain marginal actors in NECP preparation and in the articulation of linkages between NECPs and LTSs. Local authorities engage in at least seven distinct activity types directly relevant to Fit-for-55 implementation (regulation, administration, service delivery, municipal entrepreneurship, infrastructure provision, facilitation, and coordination/consultation); yet these capacities are rarely systematically mapped, mobilised, or reflected in national planning cycles.[218] As a result, NECPs often describe national ambition without embedding the territorial delivery systems required to

[214] Ibid.
[215] Ibid.
[216] Ibid.
[217] Oberthür, S., von Homeyer, I., Schewe, L. et al. (2025). Public participation in EU climate governance: the underexploited potential of national energy and climate plans. Journal of European Integration 47, 2, 257–276. https://doi.org/10.1080/07036337.2025.2460194
[218] Pūķis, M., Bičevskis, J., Gendelis, S. et al. (2023). Role of Local Governments in Green Deal Multilevel Governance: The Energy Context. Energies 16, 12, 4759. https://doi.org/10.3390/en16124759; Dobravec, V., Matak, N., Sakulin, C. et al. (2021). Multilevel governance energy planning and policy: A view on local energy initiatives. Energy, Sustainability and Society 11, 2, https://doi.org/10.1186/s13705-020-00277-y.

make those ambitions credible. The structural mismatch between the ten-year NECP horizon and the 2050 climate-neutrality objective, combined with weak procedural integration with LTSs, further undermines strategic continuity. When key sectors such as buildings, spatial planning, district heating, and local transport are not explicitly anchored in subnational delivery frameworks, the planning gap widens. This erodes confidence among international partners and investors and weakens the EU's claim to be a frontrunner in coherent, implementation-oriented climate governance.

Compliance and enforcement deficits further erode the EU's leadership claim. The Effort Sharing Regulation (ESR), which governs emission reductions in non-ETS sectors, relies on compliance checks every five years. This creates a substantial time lag between identifying non-compliance and applying corrective measures, meaning that infringement procedures may only materialise after 2032 –too late to influence the 2030 targets.[219] These structural delays are aggravated by a disconnect between target-setting and implementation capacity: local governments, which are responsible for most non-ETS mitigation measures – such as building renovation, renewable energy siting, land-use decisions, and mobility systems – are neither systematically involved in the co-design of national commitments nor meaningfully engaged in assessing the feasibility of compliance pathways[220]. Participation processes rarely influence the substance of NECPs, reinforcing a perception that national plans are politically insulated from implementation realities on the ground.[221] The absence of direct financial penalties, together with limited public visibility of progress under the ESR, further weakens incentives for early corrective action, amplifying delivery risks.

Transparency and participatory governance deficits also compromise the EU's normative leadership. Despite legal obligations under the Governance Regulation and the European Climate Law, public engagement in NECP and LTS preparation remains uneven. The analysis of Article 11 of Multilevel Climate and Energy Dialogues (MCEDs) reveals systematic shortcomings: none of the 27 member state reports covered all three mandatory themes (the climate-neutrality objective, underlying scenarios, and progress review), and many substituted one-off consultations or online information portals for genuine deliberative processes[222]. Participation was frequently confined to the late stages of plan preparation, with little evidence of feedback loops that explained how stakeholder inputs influenced outcomes. Only around half of the reported dialogues showed any degree of permanence, and the inclusion of key actors – such as institutional investors, financial intermediaries, or vulnerable social groups – was strikingly limited[223]. These patterns suggest that participatory structures often fall short of the co-creative, trust-building functions envisioned in EU law[224]. As participatory mechanisms are often designed to satisfy formal requirements rather than to build trust, enhance policy robustness, or align investment decisions with climate objectives, they weaken democratic legitimacy and reduce societal buy-in, both of which are essential for projecting a credible and replicable leadership model at the global level.

Finally, weak multilevel coordination between EU, national, and local levels limits the EU's capacity to deliver integrated climate action. Although Article 11 of the Governance Regulation mandates permanent climate and energy dialogues, their quality, scope, and institutional embeddedness vary widely across member states. Research shows that thirteen national submissions failed to demonstrate meaningful subnational involvement, and many

[219] European Climate Advisory Board. (2024). Towards EU climate neutrality.
[220] Pūķis et al. (2023). Role of Local Governments in Green Deal Multilevel Governance.
[221] Oberthür et al. (2025). Public participation in EU climate governance.
[222] Faber, R., Kocher, D., & Duwe, M. (2025). Meaningful participatory climate governance: Lessons from EU multilevel climate and energy dialogues. RECIEL 34, 2, 394–408. doi:10.1111/reel.12618.
[223] Ibid; Oberthür et al. (2025). Public participation in EU climate governance.
[224] Oberthür et al. (2025). Public participation in EU climate governance.

administrations conflated 'multilevel' governance with 'multi-stakeholder' consultation, thereby neglecting the vertical dimension of coordination across levels of government[225]. While a small number of countries – such as Denmark and Finland – have experimented with citizens' councils or juries that generate concrete policy recommendations, these practices remain isolated innovations rather than embedded advisory capacities. Strengthening Article 11 through clearer objectives, minimum quality standards, and improved reporting and Commission follow-up would turn MCEDs into the backbone of vertical coordination[226]. The absence of mandatory national climate advisory bodies further exacerbates fragmentation, leaving subnational actors – despite their central role in place-based implementation – poorly integrated into EU climate governance. Without stronger horizontal and vertical coordination, the EU risks projecting a fragmented governance model that stands in tension with its ambition to lead globally in shaping a coherent, inclusive, and implementation-credible climate transition.

[225] Faber, R., Kocher, D., & Duwe, M. (2025). Meaningful participatory climate governance; Pūķis et al. (2023).
[226] Faber, R., Kocher, D., & Duwe, M. (2025). Meaningful participatory climate governance.

7. Climate issues

This section reviews how climate issues are reflected in the EGD, the key objectives, how they are linked to the principles of a just climate transition, and how multilevel governance is reflected in the EGD's outline of climate issues.

7.1. Key Strategic Documents and Core Legislative Guidelines

One of the main objectives of the EGD is to achieve climate neutrality by 2050[227]. It is based on three main goals: 1) having no net emissions of greenhouse gases by 2050; 2) decoupling economic growth from resource use; 3) leaving no one behind during the transition. The overarching goal is to make the EU the first climate-neutral continent. EGD states the following principles in the achievement of climate neutrality[228]:

- Massive public investment and increased efforts are needed to direct private capital towards climate and environmental action, while avoiding lock-in into unsustainable practices.
- The drivers of climate change and biodiversity loss are global and are not limited by national borders; therefore, the EU should coordinate international efforts and mobilize neighbours and partners towards sustainability.
- EGD must ensure a just and inclusive transition for the communities most affected.

The EGD strategy aligns with the Paris Agreement. The long-term goal is to ensure that the global average temperature does not exceed 1.5 °C by the end of the century. Also, all countries should contribute to climate action by submitting their plans to reduce emissions, the governments should set up more ambitious targets every five years, transparency and oversight should be ensured in the reporting and solidarity in climate finance must be ensured, helping vulnerable countries to balance the reduction of emissions with building the resilience to climate change[229].

In 2020, the Commission released "The 2030 Climate Target Plan - Stepping up Europe's 2030 climate ambition," which sets a higher target for greenhouse gas emissions reduction by 2030 and outlines measures to invest in a climate-neutral future. In this plan, the Commission set a 55% reduction in GHG emissions by 2030 from 1990 levels as a legally binding target, up from the previous target of 40%. This updated target was the Nationally Determined Contribution (NDC) to the Paris Agreement. The Climate target plan introduced a new framework and policy measures to ensure the achievement of the new ambition. The main document in this plan is Fit for 55 legislative package[230], introducing a set of laws. The implementation of this package should ensure a just and socially fair transition, maintain and strengthen the innovation and competitiveness of the EU industry, and underpin the EU's position as a leader in the global fight against climate change.

The Fit for 55 package establishes a range of tools, for example, adding new provisions for carbon markets. Another important development, foreseen in Fit for 55, was the establishment of Social Climate Fund. The SCF has been criticized for having objectives that do not fully address the intersection of environmental and social issues in a holistic manner[231]. More accurate indicators

[227] European Commission. (2019). The European Green Deal.
[228] Ibid.
[229] European Commission. (2025). Paris Agreement on climate change - Consilium. https://www.consilium.europa.eu/en/policies/paris-agreement-climate/
[230] European Commission. (2025). Fit for 55.
[231] Crespy, A., & Munta, M. (2023). Lost in transition? Social justice and the politics of the EU green transition. Transfer: European Review of Labour and Research 29, 2, 235–251. https://doi.org/10.1177/10242589231173072.



are needed to assess the outcomes and effectiveness of SCF across member states, and there are concerns about the adequacy of resources allocated to SCF to meet ambitious goals[232]

A parallel development focuses on strengthening the power of individuals and civil society organizations in climate action. In 2020, the European Climate Pact was adopted by the Commission. It brings individuals, communities, and organizations together to fight climate change and adapt to its consequences. The European Climate Pact is an important platform and action to mobilize citizens from diverse backgrounds for climate action, including climate education, networking, developing and implementing solutions, and maximizing their impact. Climate Pact can enable multilevel governance of climate crises as it recognizes the role of individuals, communities, non-governmental organizations and other stakeholders in climate action.

In 2021, the European Parliament adopted the Climate Law[233], which sets legally binding targets of reducing emissions by 55% by 2030 and achieving climate neutrality by 2050. This Law allows climate targets to be more easily adopted into national legislation. The law also sets the ambition of achieving negative emissions after 2050 and introduces rules to ensure continuous progress towards the global adaptation to climate change goal in the Paris Agreement.

The Climate Law has established the European Scientific Advisory Board on Climate Change, which serves as a point of reference for the European Union on scientific knowledge relating to climate change. The latest Work Programme of the Board for the year 2025 focuses on scaling up carbon dioxide removals in the EU, strengthening climate mitigation and resilience of EU agriculture, climate adaptation and resilience, and expert and stakeholder engagement. One of the foreseen outputs is the post-2030 climate policy architecture related to mitigation and adaptation.

Further strategic documents establish the principles for assessing national energy and climate plans. In 2023, the Commission adopted "EU-wide assessment of the draft updated National Energy & Climate Plans" which assessed member states' plans for 2030/2040 in the context of the EGD and the push for more ambitious action. This assessment estimates GHG emissions in 2030 will be 51% lower than in 1990, 4 percentage points short of the 55% target set in the Climate Law. Therefore, the need for enabling measures, including enhancing carbon removals, was identified. The updated NECPs in 2023 reflected increased challenges to achieving a more resilient EU, including the consequences of the war in Ukraine. In response to these challenges, the Commission has established the RRF to build more sustainable and resilient EU economies. This document identified the ambition gaps among the member states to achieve increased targets and objectives for 2030 and the failure of some members to submit their NECPs on time. The Commission identified the need for a simplified regulatory environment, with a stronger focus on competitiveness, innovation, and investments.

7.2. Obstacles and Limitations

While EGD frameworks reflect unprecedented ambition, the academic literature consistently highlights systemic limits and obstacles that challenge effective implementation. A major challenge concerns the EU's complex multi-level governance structure, which creates implementation gaps between EU-level ambition and national-level execution[234]. The EU Climate

[232] Perissi, I., Natalini, D., & Jones, A. (2023). Assessing the Emissions Related to European Households' Expenditures and Their Impact on Achieving Carbon Neutrality. Climate 11, 10, 203. https://doi.org/10.3390/cli11100203.
[233] European Parliament & Council of the European Union. (2021). European Climate Law,
[234] Oberthür, S., & von Homeyer, I. (2021). EU climate governance from emissions trading to the Green Deal. Climate Policy 21, 6, 743–757, https://doi.org/10.1080/13501763.2022.2120528-



Law attempts to address these gaps by making the goals legally binding[235]. However, binding targets alone do not guarantee consistent national action. The EU-wide Assessment of Updated NECPs reveals substantial discrepancies among member states, including delays in submitting updated plans, inconsistent policy measures, and a collective shortfall of approximately 4 % toward the 55% target[236].

Governance and regulatory fragmentation remain a central limitation of EU climate policy. The EU's multi-level governance structure gives member states wide discretion in implementation, creating gaps between EU-level ambition and national execution. Although the European Climate Law makes the climate goals legally binding, it cannot by itself ensure consistent national delivery. Fragmented governance and uneven national implementation continue to limit the effectiveness of EU climate regulation despite strengthened legal frameworks. Indeed, legal mandates do not automatically translate into coordinated implementation**,** particularly in politically sensitive sectors such as energy and transport. A key obstacle is that fragmented governance weakens the coherence, consistency, and long-term predictability needed to drive rapid and effective decarbonization.

Moreover, ambition across EU documents relies heavily on large-scale public and private investment. The 2030 Climate Target Plan emphasises the need for "massive public investment and mobilization of private capital," warning of potential lock-in risks if investments fail to align with long-term climate goals[237]. Similarly, Fit for 55 includes extensive reforms to the ETS and introduces the SCF to compensate vulnerable households[238]. Despite this, economic studies argue that funding remains insufficient relative to the €350–500 billion annual investment requirement[239]. A key obstacle is that inadequate, unevenly distributed, and unpredictable financing undermines both the feasibility of the transition and its fairness across regions and social groups.

The 2030 Climate Target Plan and Fit for 55 both acknowledge that achieving higher GHG cuts requires accelerated deployment of mature and emerging technologies, including renewable energy, hydrogen, electric mobility, and carbon capture[240]. However, research shows that the EU remains constrained[241] by slow permitting procedures for renewable energy, insufficient grid capacity and storage, heavy reliance on imported critical raw materials, and technological path dependencies in transport, heavy industry, and buildings. The 2040 Climate Target Communication confirms these limitations, stressing the need to expand carbon removals – both

[235] European Parliament & Council. (2021). European Climate Law.
[236] European Commission. (2023). EU-wide assessment of the draft updated National Energy and Climate Plans, https:// commission.europa.eu/system/files/2023-12/EU-wide_assessment_draft_updated_National_Energy_ Climate_Plans_ 2023.pdf
[237] European Commission. (2020). 2030 Climate Target Plan: Stepping up Europe's 2030 climate ambition (COM(2020) 562 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52020DC0562
[238] European Commission. (2021). Fit for 55 Package.
[239] Claeys, G., Tagliapietra, S., & Zachmann, G. (2021). How to make the European Green Deal work. Bruegel Policy Contribution, https://www.econstor.eu/handle/10419/237632; Egenhofer, C., et al. (2021). Financing the European Green Deal. CEPS. https://cdn.ceps.eu/wp-content/uploads/2021/07/European-Green-Deal_CEPS-TF-WGR.pdf
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natural and technological – to meet a 90% reduction by 2040[242]. A key obstacle is that technological lock-in and infrastructure gaps slow the pace and limit the effectiveness of decarbonization efforts.

The EGD stresses the principle of 'leaving no one behind', and both Fit for 55 and the 2040 Climate Target Communication emphasize fairness and solidarity as central to public support[243]. However, social acceptance remains fragile[244]. Carbon pricing hits low-income households hardest, rural and industrial regions fear job losses, and agricultural lobbies resist stricter CAP targets. While compensation mechanisms help, they may be insufficient to fully address these socioeconomic and sectoral challenges, limiting broad public support for a just transition. The EU-wide Assessment of NECPs highlights a lack of forward-looking socio-economic planning in member-state policies, particularly regarding vulnerable households and regions[245]. A key obstacle is that, without stronger redistributive measures, climate policies risk sparking political backlash and undermining public trust. European policies remain partially misaligned with EGD ambitions. The 2030 Climate Target Plan acknowledges discrepancies in transport, buildings, agriculture, and land use[246]. Scholars[247] have noted that, however, transport emissions continue to rise, the CAP still subsidises practices incompatible with climate goals, and industry decarbonization remains limited by competitiveness concerns.

The *2040 Climate Target Communication* attempts to provide long-term clarity by setting a 90% reduction goal, yet it also highlights new uncertainties[248], the need for large-scale carbon dioxide removal, volatile global energy markets, and geopolitical risks. These factors make long-term planning challenging, requiring flexible strategies that can adapt to technological, economic, and political shifts. Researchers argue that such uncertainties complicate long-term planning and pose the risk of underinvestment in strategic technologies.

7.3. Connection with Multi-level Governance

The assessment of the progress of EU member states in the context of the multidimensionality of EGD can be done using the Multiple Criteria Approach (MCA). An analysis [249] has identified significant differences across EU countries, which form three clusters of the level of achievements: high, medium, and low. Among EU member states, Sweden has the strongest performance in reducing climate impact, Slovenia was the best in the cluster 'protecting planet and health', and Belgium received the highest scores in the evaluation of green and just transition.

[242] European Commission. (2024). Securing our future: Europe's 2040 climate target and path to climate neutrality by 2050 (COM(2024) 63), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52024DC0063
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[248] Anderson, K., & Peters, G. (2016). The trouble with negative emissions. Science, 354, 6309, 182–183; Newbery, D.M., (2016). Towards a green energy economy? The EU Energy Union's transition to a low-carbon zero subsidy electricity system – Lessons from the UK's Electricity Market Reform, Applied Energy 179, 1321–1330, https://doi.org/10.1016/j.apenergy.2016.01.046; Scholten, D., Bosman, R. (2016). The geopolitics of renewables; exploring the political implications of renewable energy systems, Technological Forecasting and Social Change 103, 273–283. https://doi.org/10.1016/j.techfore.2015.10.014.
[249] Ottomano Palmisano, G., Rocchi, L., Negri, L., et al. (2025). Evaluating the Progress of the EU Countries Towards Implementation of the European Green Deal: A Multiple Criteria Approach. Land 14, 1, 141. https://doi.org/10.3390/LAND14010141.



These differences highlight the importance of nationally tailored policies and actions to achieve EGD goals in climate issues.

Achieving the 90% net target by 2040 will require both deep emission cuts and a substantial increase in carbon removals from the atmosphere to balance residual emissions. This includes both nature-based solutions (e.g., reforestation, soil regeneration) and technological solutions (e.g., direct air capture with storage, bioenergy with carbon capture storage). The Commission recognizes that fairness, solidarity, and social policies should be at the core of the transition, helping vulnerable citizens, regions, businesses, and workers through tools such as the Social Climate Fund and Just Transition Fund. Open dialogue with diverse stakeholders is also a crucial precondition for a just transition. The Commission realizes the need to secure public engagement on the next steps and policy choices[250], which are at the core of multilevel governance principles. As the impacts of climate change on humans are increasingly severe, the open dialogue must be strengthened with all concerned stakeholders, including farmers, businesses, social partners, and citizens. There is an urgent need for action to ensure resilience against future crises. Multilevel governance in the EGD implementation of climate change policies should include not only horizontal and sectoral coordination, such as collaboration among various actors, including trade offs between different objectives and finding a balance between coordination and competition[251], but also vertical coordination, ensuring the inclusion of marginalized communities and policy implementation at national and local levels[252].

The EGD represents the world's most comprehensive climate framework, yet its implementation faces substantial limitations. Across governance, financing, technology, social justice, sectoral alignment, and long-term planning, the gap between ambition and implementation remains significant. EU documents – 2030 Climate Target Plan, Fit for 55, EU Climate Law, NECP Assessment, and 2040 Target Communication – acknowledge many of these barriers themselves, reinforcing academic findings. Addressing these systemic challenges will be critical to ensuring that the EU achieves climate neutrality by 2050.

[250] European Commission. (2024). Recommendation for 2040 target to reach climate neutrality by 2050, https://commission.europa.eu/news-and-media/news/recommendation-2040-target-reach-climate-neutrality-2050-2024-02-06_en

[251] Tagliapietra, S., & Veugelers, R. (2021). Fostering the Industrial Component of the European Green Deal: Key Principles and Policy Options. Intereconomics 56, 6, 305–310, https://doi.org/10.1007/s10272-021-1006-5

[252] Clement, J., Alarda, L., Ochojski, A. et al. (2025). Engaging marginalized communities in multi-level transformative innovation policy: The case of the Just Transition Fund. Technological Forecasting and Social Change, 212, 124002, https://doi.org/10.1016/j.techfore.2025.124002



8. Conclusion

The main aim of this report was to provide an examination of the EU's existing strategic documents on the 'green' dimension of the twin just transition, their limitations and connection to the multilevel governance approach. The report examines six key elements of the EGD and other strategic documents that are guiding the EU's transition towards a carbon-neutral economy by 2050. The second section, on energy security, concluded that the EU's energy security agenda contains several tensions. The first one concerns the balance between long-term structural transformation and short-term crisis management – while the long-term goal of decarbonization is clear, and it also contributes to energy security, short-term reactions to energy security crises can go against these long-term objectives. Moreover, the linkage between green and digital transition is not necessarily synergetic as digital transition generates new energy demand and uncovers systemic vulnerabilities. This raises doubts about whether digitalisation, as currently embedded in market logics, can in fact deliver the socially just and ecologically sustainable secure-energy system that EU policy documents promise.

The third section examined EU's clean and sustainable economy in the EGD and other related documents. It argued that this decarbonisation agenda in the EGD is an ambitious attempt to integrate climate neutrality, resource recycling, and social justice into a single master plan. However, while this plan is a complex and comprehensive one, it includes persistent obstacles that limit the speed of the green transition. These obstacles include, among others, investment gaps, governance fragmentation, socio-political resistance, and global dependence of the EU. Therefore, achieving the EU's clean and sustainable economy goals depends less on new overall objectives and more on strengthened multi-level coordination, procedural legitimacy, and regionally conscious implementation, thereby translating normative goals into lasting and equitable practical outcomes.

The following section of this report presented strategic European documents connected to sustainable and smart mobility. The EU often acts merely as a rule-setter, lacking sufficient executive powers, which complicates implementation at the national level. Since sustainable mobility falls within the national competence of the member states, unavoidable conflicts of interest arise between them. An important obstacle to the transport transition is that many funding instruments remain tied to expanding the road network; they are often used to eliminate congestion or bottlenecks, which, in practice, leads to further road construction and prevalence of car-oriented mobility system. Similarly to renewable energy systems, public acceptance is also an issue in connection to sustainable mobility (for example, cycling infrastructure in cities).

The fifth section examined the research and innovation sector. While there are strategic documents, objectives as well as funding supporting research and innovation, the EU is having a hard time becoming an innovation leader. EU research institutions are not attractive for international talent and also mobility of talent within the EU is not optimal. Lack of coherence in tertiary education across the EU creates formal and informal barriers that should be dismantled to strengthen the EU's innovation potential. This is crucial so the EU can benefit from a first-mover advantage in the area of low-carbon or decarbonised technologies. Support for research and innovation in science and engineering should be complemented by support for the social sciences to help answer questions about public resistance to decarbonisation across sectors.

The EU's ambition to act as a global climate and energy leader depends on the strength and coherence of its governance system, argued the sixth section of the report. While the EU has developed a comprehensive set of strategies, legal instruments, and external engagement tools, governance challenges across multiple levels continue to shape the credibility and effectiveness of its global action. Misalignment between EU-level strategies and national implementation limits the EU's ability to act as a unified international actor. Moreover, effective global leadership



also requires robust participatory governance, particularly involving sub-national authorities. Cities and regions often deliver core climate actions and generate innovative practices, yet their perspectives remain only partially integrated into EU external climate strategies.

Section seven discussed climate issues in the strategic documents supporting decarbonisation. The energy sector is the key factor in GHG mitigation, and it produces most of the emissions, and therefore, energy transition is closely connected to climate policy. The section argues that the EGD represents the world's most comprehensive climate framework, yet its implementation faces substantial limitations. Across governance, financing, technology, social justice, sectoral alignment, and long-term planning, the gap between ambition and implementation remains significant. Indeed, addressing these systemic challenges will be critical to ensuring that the EU achieves climate neutrality by 2050.

8.1 Policy Recommendations

- Strengthen the common EU-wide ability to react to critical situations in a common way so that a short-term solution to crises is in line with long-term decarbonisation goals. In other words, make sure that some member states will not turn to fossil fuels as a solution to energy security challenges, but there will be an agreement at the EU level that renewable sources of energy (and nuclear for some member countries) are the preferred solution.
- Develop new digital rules and governance with the focus on energy efficiency and their ability to support the green transition. Further digitalisation cannot happen at the price of increased energy consumption, which will hinder the energy transition.
- The existing goals can help develop a carbon-neutral economy in the EU. There is no need to develop new goals, the EU should strengthen multi-level coordination, procedural legitimacy of individual goals, and support regionally conscious implementation in order to decarbonise its economy by 2050.
- The EU needs to pay increased attention to socio-political resistance to its green objectives. To do this, research on this resistance needs to be supported to learn about its sources and the factors that support its spread across the EU. Technological innovations are unable to support EU's decarbonisation if they could not be employed due to public resistance.
- Funds supporting the development of mobility infrastructure should refocus from individual transport, represented especially by cars, to alternative modes of transportation. The latter should be prioritised due to their high – and for now only minimally utilised – decarbonisation potential.
- Like renewable energy sources, alternative mobility options are also often the subject of public resistance. This should be studied so policy-makers can adjust existing policies to increase acceptance of alternative (decarbonised or low-carbon) mobility.
- Revise the Innovation Fund in a way that it will support more ambitious – and therefore also riskier – projects. In its current form (already revised in 2018), the Fund's ability to support cutting-edge, high-gain, high-risk decarbonisation projects is limited.
- Increase support for mobility within the EU so that talent can more easily find a suitable environment for their research. This is linked to a broader issue of deeper integration in education policy that will improve the mobility of people with tertiary education by removing formal, but also informal barriers.
- The EU should improve coordination between the EU institutions and member states in matters of energy and climate policy, as the current misalignment prevents the EU from

being a more active actor at the global level. For example, domestic fossil fuel subsidies send mixed signals to the global partners about the EU's dedication to decarbonisation.

- CBAM is the crucial tool for the EU to prevent carbon leakage and support its domestic decarbonisation while providing climate leadership. Therefore, the EU should protect this instrument and prevent its dismantling vis-à-vis increased pressure from many actors within and beyond the EU .
- The EU should create a tool that will close the gap between EU-level climate ambitions and national-level execution. The EU is currently experiencing policy backlash against its main climate policy goals as well as tools supporting these goals (especially ETS and ETS 2).
- All levels of governance should be effectively involved in climate policy and climate change mitigation tools. Various levels of governance can help in various ways; however, all are needed to reach the ambitious goal of carbon neutrality by 2050. Such an approach can not only smooth decarbonisation and distribute it more evenly among various actors, but also increase its acceptance among the public as it will bring the decarbonisation changes closer to the people.