

Which policy mix should lead the EU to climate neutrality?

Lessons from the integrated assessment of four policy avenues.

Main findings or recommendations:

1. To reach climate neutrality by 2050, the EU faces transformation gaps in the areas of innovation, investment, infrastructure, and integration. 4i-TRACTION analysed the ability of four different policy avenues to close the gaps. This policy brief summarises the main findings for EU policy.
2. Robust and credible carbon pricing remains key to accelerate the market diffusion of cleaner alternatives and accelerate the market exit of fossil technologies. Yet to become future-proof, emissions trading in Europe needs stronger social guardrails.
3. The EU must step up its industrial policy and address the investment gap, boost innovation support, and coordinate the deployment of the infrastructure that is needed for industry transformation. An important step is to scale up the Innovation Fund with carbon contracts for difference and increased funding.
4. The EU should develop planning capacities and set-clear phase-out timelines for fossil value chains. An EU policy for integrated infrastructure planning is an important step to accelerate the energy transition.
5. The EU should harness the potential of sufficiency, especially in areas where technology may be insufficient, such as mobility and food. More sustainable lifestyle choices must be enabled through *inter alia* public investments in infrastructure.

Policy Avenues towards climate neutrality

With the Green Deal, the EU has expressed its transformative ambition. However, the EU is not on track to climate neutrality by 2050 (e.g., ESABCC, 2024), and several **transformation gaps** still exist (Görlach et al., 2024):

- Progress is lacking across the **innovation** chain, including limited and incoherent funding and lack of directionality.
- The climate **investment** gap is in the order of €406 billion annually and the existing framework is insufficient to mobilise it.
- The roll-out of **infrastructure** for a climate-neutral economy is too slow, especially for energy and transport infrastructure, also due to a lacking comprehensive strategy for transnational infrastructure.
- Climate policy **integration** is still uneven across sectors and limited in agriculture and transport. The coordination of innovation,

investment, and infrastructure is still deficient.

There are diverse and competing approaches to climate policy in the EU, based on different perceptions of the nature of the problem that climate policy needs to solve and the right policy instruments and governance frameworks to do so. In the 4i-TRACTION project we develop four “policy avenues” (PA) for the EU – different combinations of policy instruments that reflect such distinct approaches to the design of climate policy (Görlach et al., 2022). We then assess how these policy avenues perform in addressing the transformation gaps of innovation, investment, infrastructure, and integration (Görlach et al., 2024).

This policy brief draws lessons from this assessment for EU climate policy in the next legislative cycle and beyond.

EU climate policy: a blend of different approaches

Climate policy in the EU evolved over time and was influenced by different interests, institutions, and ideas that shaped policy, also in response to social, political, and economic developments.

Climate policy emerged from the EU’s environmental policy, which traditionally relied on command and control-type regulation, such as bans, standards, and limits. This legacy still shapes some EU climate policy today.

The core of the EU’s climate policy, however, took shape in a time with a strong liberal and market-based consensus in the late 1990s and early 2000s. It consequently has a strong

imprint of market-liberal approaches, which is reflected in emissions trading serving as the key policy instrument in the EU’s climate policy mix.

In response to the limits of emissions trading, changing ideas about the role of state intervention, as well as (geo-)political developments, industrial policy has been increasing in influence in the EU’s policy. It will likely continue to play an important role in the future.

Sufficiency and degrowth thinking offers a different approach to policy design, which, however, has not impacted EU climate policy in a structural way. While some policy instruments

do intend to elicit demand responses, they are not motivated by the aim to reduce economic output or demand on aggregate.

In consequence and looking at the EU's existing climate policy instruments, there is no single dominant paradigm. Rather, the current instrument mix reflects influences from different schools of thought. Table 2 in the Annex provides a categorisation of the EU's policy instruments along the four policy avenues.

- **Green Economic Liberalism** is recognisable in instruments such as the EU ETS, the forthcoming ETS 2 as well as the Carbon Border Adjustment Mechanism.
- **Green Industrial Policy** is anchored in the different innovation and infrastructure funding programmes such as the Innovation Fund or InvestEU, but also in new initiatives such as the Net Zero Industry Act.
- The **Directed Transition** approach is represented in the different standards such as on F-Gas, energy efficiency, or for vehicle CO₂ emission, as well as the extensive planning and target setting at EU level.
- **Sufficiency and Degrowth** is mentioned in strategies and political communication – but not represented by dedicated policy instruments in the existing climate policy mix.

Four policy avenues towards climate neutrality in the EU

Based on stakeholder input and prevailing policy paradigms, Görlach et al. (2023) developed four policy avenues for the EU. They are all geared at achieving climate neutrality but differ in the choice of instruments and their regulatory philosophy.



Green Economic Liberalism strengthens market-based instruments like emissions trading and seeks to limit direct interventions in markets and business decisions. In many ways, it represents a continuation and intensification of existing EU climate policy.



Green Industrial Policy actively seeks to build a climate neutral economy by increasing public investments in R&D, clean manufacturing, and infrastructure, requiring capable, mission-oriented governance and extensive coordination from EU institutions.



Directed Transition fosters change through active government intervention using EU-level targets, sectoral pathways, carbon budgets, and strict standards, requiring the development of institutions and governance mechanisms for coordination.



Sufficiency and Degrowth aims to reduce material and energy use by encouraging sufficiency and policies like banning emission-intensive technologies and activities, involving governance innovations and challenging prevailing objectives, such as green growth.

Which policy avenues addresses the challenges best?

Our analysis assessed which of the different policy avenues is best equipped to deliver transformative climate policy, placing the EU on track to achieving climate neutrality by mid-century while addressing the combined transformation challenges of innovation, investment, infrastructure, and integration. An overview of the results is provided in the Annex.

Our assessment finds that neither of the four avenues offers a superior approach in all respects, but instead it revealed strengths and weaknesses of the different policy avenues and suggested aspects where some avenues are better suited than others.

- The Green Economic Liberalism Policy Avenues is strong in the **deployment of market-ready solutions** and disincentivising fossil-based technologies. It is less strong, however, where directionality is needed – in particular for tackling the infrastructure challenge. Its relatively low demands for state capacity and planning may be a comparative strength.
- Green Industrial Policy shows overall strengths, especially due to its relatively

strong performance on tackling innovation, investment, and infrastructure. This is primarily because of the policy avenues explicit focus on **directing and supporting technological change** through different mechanisms (economic incentives, planning, and regulation). However, given its reliance on public investments and high demands for state capacity, the political and administrative feasibility of this approach can be questioned.

- The Directed Transition Policy Avenue is strong in providing **directionality and planning**, but weak when it comes to mobilising investments and dynamic incentives for innovation.
- Sufficiency and Degrowth shows overall weaknesses in tackling the transformation challenge and faces the highest political hurdles. However, it is relatively strong in its explicit focus on **phase-out policies** and in those instances where technological solutions may not become available at the needed scale and cost and in the timeframe available, e.g. regarding meat consumption or long-distance travel.



Diffuse commercialised clean alternatives on the market.



Accelerate technological change through public investment & innovation support.



Provide directionality & certainty through planning and standards.



Trigger lifestyle changes where technology is insufficient / unavailable.

Reforming the EU's policy mix towards greater transformative capacity

The transformation to climate neutrality is a daunting political, economic, and social challenge. It requires profound changes in all sectors in a short time. To stay on track, EU policymakers must tackle the identified transformation gaps in the next legislative cycle. Our analysis of policy avenues for the EU delivered several insights for the future direction of EU climate policy, summarised in the policy recommendations below.

Evolution instead of revolution. A “pure” policy mix that follows a single policy paradigm would require fundamental reforms to the architecture of EU climate policy. Not only does this seem politically unfeasible and would in any case take years to implement – it is also unclear if such a pure policy mix will indeed be more effective and efficient. The EU is therefore better advised to develop the existing policy mix, address existing bottlenecks and develop solutions for the challenges of innovation, investment, infrastructure, and integration.

The EU must step-up its green industrial policy. Targeted interventions, support, and coordination are important to foster the development of clean industries and to support the transformation of existing ones. Given the international clean technology competition, decisive action is needed for the EU to keep up with the technological frontier and catch the right moment in the investment cycle. The EU needs to close the investment gap, boost innovation support, and coordinate the deployment of the infrastructure that is needed to support industry transformation. This must include an increase in public investment and

build on existing instruments such as the Innovation Fund or NextGenEU. Industrial policy must be better coordinated at EU level, with a clearer focus which industries and technologies the EU should seek to develop and deploy. One key requirement for this strategy is a firm and credible commitment to provide the necessary financial resources at EU level (see also Rienks & Moore, 2023), another to build up the administrative and informational capacity.

Maintain and strengthen the EU ETS. The ETS is essential for the efficient deployment of clean solutions, to unlock green investments and discourage brown ones. Recent reforms have strengthened the role of carbon pricing in the EU's climate policy mix. Maintaining the credibility and integrity of the EU's ETS must be a priority for policymakers – and requires a firm commitment, especially in times of rising carbon prices. Increasingly, the EU ETS' function will be to put fossil-based assets out of business – a solid flanking with social support measures is therefore needed.

Planning is crucial for resolving coordination failures and providing direction. Strategies and targets are important for directing technical change, especially where infrastructure must be in place to progress (electricity grids, green hydrogen or CCUS). To provide such orientation, EU climate policy must involve strategic, cross-sectoral planning of abatement options and overarching coordination. Stronger EU Integrated Infrastructure Planning may be important for accelerating the energy transition, as outlined in our case study (Vendrik et al., 2023).

Standards can also provide direction for technological change and certainty for consumers, producers, and investors. In this way, they can be an important complement to price-based policies. For example, the EU's performance standards for the energy efficiency of appliances or emission standards for light-duty vehicles provide clarity on the future timeline of technologies, including the eventual end-date of fossil-based technologies and associated value chains. Following these examples, the EU should enact timelines for improving the circularity of products and phasing out other fossil technologies, *inter alia* through the Ecodesign Regulation or the Energy Performance of Buildings Directive.

Lead markets are an important intermediary measure to make climate-neutral products cost-competitive. Climate-neutral products must eventually become competitive with conventional ones; but carbon pricing alone may not get them there. Lead markets can guarantee demand for clean alternatives, create an incentive to invest and scale up technologies, and bridge the cost gap to conventional products. The EU should explore the potentials of public procurement (see Mähönen et al., 2023) and tradable quotas for basic materials to create such lead markets for climate neutrality.

EU policy must develop tools to address the potential of sufficiency policies. Lifestyle and behavioural changes are part of the response to climate change, in particular to address those decarbonisation challenges where no suitable (technological) alternatives can be foreseen at the cost, scale, speed and convenience needed. For some emission sources (such as meat consumption or long-distance travel), changing lifestyles and

consumption behaviour is inevitably part of the solution. So far, there is hardly any EU policy for tackling these issues, and as a result little experience which instruments may or may not work to bring about behavioural changes.

The EU should embrace the complementarities of the policy avenues.

Instruments from each avenue create conditions that may help the success and feasibility of others. For example, carbon pricing reduces the need to subsidise cleaner alternatives as it makes dirty options relatively less competitive. Public investments and innovation support addresses some of the gaps of carbon pricing and help create the clean technologies that can then be diffused through market-mechanisms. Integrated planning can address the coordination failures that pose a barrier to technological change, such as missing infrastructure. Enshrining phase-out goals in regulation provides clarity, while carbon pricing erodes the economic viability of fossil-based value chains and assets. Finally, using market-based policies reduces the informational and administrative requirements of the transition as decisions are decentralised to the market.

Sequencing of policies is crucial. Policy needs change over time as the transformation progresses. This means policy instruments must be sequenced accordingly. Innovation support will be crucial now and in the coming years, to enable deep emission reductions in the future, develop industries and business models, and to scale up investments into climate-neutral technologies. Planning and standards must set a medium- to long-term vision particularly for infrastructure, given long lead times. Market-correcting policies will remain important throughout the transition, so that markets can do some of the heavy lifting

in the transformation to climate-neutrality – and increasingly, to push fossil-based technologies out of the market. Sustainable lifestyles will be essential in the long-term, but

must be prepared through the right social, technological, and infrastructural conditions, and an approach that involves citizens rather than alienates them.

Recommendations for the EU Policy mix

Green Economic Liberalism elements can **maintain a robust, credible, and ambitious carbon pricing strategy.**

- ▶ Future-proof the ETS I and II by extending social compensation mechanisms.
- ▶ Ensure other markets and energy taxation are aligned with ETS, including the electricity market.
- ▶ Strengthen market-based approaches, such as green lead markets for climate-friendly products.

Green Industrial Policy elements can **accelerate technological change through coordinated innovation support, public investments, and infrastructure development.**

- ▶ Strengthen public institutions and administrative capacities to manage the process of technology and innovation support at EU and MS level.
- ▶ Scale up Innovation Fund with carbon contracts for difference and increased funding.
- ▶ Increase public investments in clean transition and improve coordination through strategic investment plans at MS level.

Directed Transition elements can **develop planning capacities at EU and MS level and set-clear phase-out strategies for fossil value chains.**

- ▶ Develop an EU integrated infrastructure policy to improve the (transboundary) planning of (energy) infrastructure (Vendrik et al., 2023).
- ▶ Set credible standards to phase-out emission-intensive products and processes, inter alia through the delegated acts of the Construction Products Regulation or the Ecodesign for Sustainable Products Regulation.

Sufficiency and Degrowth elements can **enable lifestyle changes and sufficiency where needed.**

- ▶ Improve quality and access to low-emission public mobility by, among others, scaling public investments.
- ▶ Deploy infrastructure for active mobility (walking and cycling) .
- ▶ Tax emission-intensive luxury consumption (such as frequent flyers, private aviation).
- ▶ Use participatory and deliberative approaches to develop policies for addressing behavioural and lifestyle changes regarding, for example, diets and mobility

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Annex

Table 1 Strengths and weaknesses of the policy avenues across the transformation challenges

	Green Economic Liberalism	Green Industrial Policy	Directed Transition	Sufficiency & Degrowth
Innovation	Strong on deployment of mature technologies and disincentivising fossil technologies	Strong across full innovation chain with focus on investment in RD&D, deployment, and providing directionality	Strong across full innovation chain with focus on standards, RD&D funding, and exnovation.	Strong in providing directionality and exnovation of fossil technologies
	Weak on providing certainty and directionality as well as sufficient R&D funding.			Weak on demonstration and deployment of innovations.
Investment	Strong in preventing investments in climate-forcing assets and correcting information-related market failures.	Very strong in mobilising public and private climate investments to close investment gap. Strong in preventing investments in climate-forcing assets.	Very strong in preventing investments in climate-forcing assets.	Strong in preventing investments in climate-forcing assets.
	Weak in committing public climate investments.			Weak in mobilising public and private climate investments
Infra-structure	Blindspot in approach. Weak on planning and making explicit infrastructure / technology choices.	Very strong due to integrated planning of infrastructure along industrial policy priorities.	Very strong due to integrated planning of infrastructure and clear directionality.	Weak due to adversity towards new energy infrastructure demands
Integration	Strong in mainstreaming climate through ETS.	Strong in coordination of industrial policy priorities.	Strong on mainstreaming climate and coordinating sectors through planning.	Strong on mainstreaming climate and enviro. through new policy priorities.
	Weak in coordinating sectors and decision-making (infrastructure and investment).	Weak in mainstreaming climate in all areas (such as agriculture). High admin demands.	Weak on providing adequate administrative capacity.	Weak on administrative capacity; coupling of sectors; and integrating investment with innov. & infra.
Politics	Mixed: Continuation of dominant approach but difficulty of high carbon prices.	Difficult: high demands for state capacity and public investments	Difficult: high demands for state capacity; strong break w/ status quo	Very difficult: Fundamental departure from existing approach

Table 2. Alignment of key EU climate policy instruments with the four policy avenues

Instrument	Legislation	GEL	GIP	DT	S&D
GHG emissions cap & trade systems: ETS 1 & ETS 2	ETS Directive	high	medium		
Carbon Border Adjustment Mechanism	Carbon Border Adjustment Mechanism Regulation	high	medium		
Obligatory energy performance certificates for new buildings	Energy Performance of Buildings Directive	high			
Mandatory energy consumption audits for large companies	Energy Efficiency Directive	high	low		
Social Climate Fund	Social Climate Fund Regulation	high	medium	medium	medium
Horizon Europe research & innovation programme	Horizon Europe Regulation	medium	high		low
LIFE Programme	LIFE Regulation	medium	high		
Net Zero Industry Act (<i>assessed as one bundle</i>)	Net Zero Industry Act (<i>proposal</i>)	low	high		
InvestEU Programme	InvestEU Regulation	low	high		
Innovation Fund	ETS Directive	low	high		
Sustainable finance taxonomy	Taxonomy Regulation	low	high	low	
Just Transition Fund	Just Transition Fund Regulation	low	high	low	medium
Modernisation Fund	ETS Directive	low	high	high	
Renovation requirements for the public sector	Energy Efficiency Directive		medium	high	
CO ₂ emission standards for cars and vans	Regulation Setting Emission Standards for Passenger Cars and Vans		medium	high	
Limits and bans on F-gas usage	F-Gas Regulations		medium	high	
Bans on methane venting and flaring, mandatory leak detection and repair	Regulation on Methane Emissions in Energy Sector (<i>proposal</i>)			high	
Obligations for net-zero buildings & mandatory solar energy installations, Electric Vehicle (EV) charging and bike parking infrastructure, minimum energy performance standards	Energy Performance of Buildings Directive		low	high	low
Minimum energy efficiency standards for energy-related appliances, performance & information requirements for most physical goods categories	Ecodesign Directive		medium	high	medium

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Date

06.05.2024

Suggested citation

4i-TRACTION (2024): Which policy mix should lead the EU to climate neutrality? Lessons from the integrated assessment of four policy avenues. Ecologic Institute, Berlin.

Acknowledgements

The authors thank the numerous colleagues, stakeholder, and experts that contributed directly or indirectly to the reports underlying this policy brief. All errors remain our own.

Project partners



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement **No. 101003884**.