



IMPULSE

EU policies for climate neutrality in the decisive decade

20 initiatives to advance solidarity,
competitiveness and sovereignty

→ Please cite as:

Agora Energiewende (2024): EU policies for climate neutrality in the decisive decade: 20 initiatives to advance solidarity, competitiveness and sovereignty.

Impulse

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20 initiatives to advance solidarity, competitiveness and sovereignty.

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Acknowledgements

We would like to thank all colleagues across the Agora Think Tanks who supported this project in many ways, including insightful reviews, and especially: Kaisa Amaral, Nelly Azais, Eleanor Batilliet, Helen Burmeister, Tanja Dräger, Wilhelm Klümper, Alexandra Langenheld, Jahel Mielke, Simon Müller, Ulf Neuling, Frank Peter, Christopher Schröder, Alexandra Steinhardt, Frauke Thies, Stephanie Wunder.

Preface

Dear reader,

Negotiators from the Council and the European Parliament are wrapping up the last elements of a comprehensive update of EU climate and energy laws that aim at reducing greenhouse gas emissions in Europe by 55 percent by 2030.

With European elections in June and the appointment of a new European Commission in November 2024, there is growing interest in climate policy priorities in the 2024–2029 EU policy cycle. An effective implementation of the Fit for 55 policy package will be a major focus. In addition, the political focus will already be on the time after 2030. New policy initiatives will face a different political context compared to five years ago as solidarity, industrial competitiveness, and sovereignty concerns have moved to the

fore. Policies for the post-2030 period also need to address a different set of issues and dynamics than pre-2030 policies.

This discussion paper pulls together expertise from across the Agora Think Tanks. As a starting point for a dialogue, we make recommendations for 20 policy initiatives across all sectors to advance EU policies for climate neutrality in this decisive decade.

We hope you enjoy the read and look forward to your comments and a fruitful exchange.

Frauke Thies
Executive Director, Agora Think Tanks

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→ Key findings at a glance

- 1 **Europe needs to consider the climate crisis in all policy areas – from security to fiscal planning, agriculture to industrial development – as it seeks feasible solutions for achieving net zero by mid-century.** Following European elections in June 2024, the EU will need to set a greenhouse gas emission reduction target for 2040 and build on the “Fit for 55” package. New policy initiatives should strengthen solidarity, competitiveness and sovereignty while maintaining a sound financial basis.
- 2 **The successful transition requires broader public support and active engagement of citizens.** The next EU Commission should take initiatives to make climate-friendly heating, cooling and mobility options affordable and accessible, and develop a European Rural Deal to enable farmers, forest owners, and rural communities to benefit from the transition.
- 3 **Greening Europe’s industrial base while strengthening strategic cleantech competitiveness and resilience should be at the core of the next Commission’s work programme.** Policy initiatives should prioritise direct electrification technologies for industrial heat, deployment funding for green basic materials production, leveraging Europe’s single market to drive demand, growing strategic clean industrial manufacturing at home, and incentivising diversification of green global value chains.
- 4 **The next mandate needs to ensure sufficient EU funding for the transition to climate neutrality.** The EU budget for 2028–2034 should increase overall funding available for the transition by allocating funds across the budget more closely with climate investment needs. A new climate fund should fill the gap after the Recovery and Resilience Facility ends, financed with a balanced mix of sources including carbon pricing revenues and EU debt. In the future, EU funding can also play a stabilising role as governments will see gradually declining revenues from taxing fossil fuels while the EU advances towards climate neutrality.

20 policy initiatives to advance solidarity, competitiveness and sovereignty



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1 Introduction: Climate and energy policy in the next EU legislative cycle

We are nearing the end of this policy cycle. Negotiators from the Council and the European Parliament are wrapping up the last elements of a comprehensive update of climate and energy legislation to reduce greenhouse gas emissions in Europe by 55 percent by 2030 and to achieve a climate-neutral continent by 2050. The current policy cycle was shaped by two major crises, namely the COVID-19 pandemic followed by Russia's invasion of Ukraine and the ensuing fossil energy crisis. Driven by security concerns, the past 18 months brought Europeans much closer together on energy policy, helped deliver an ambitious climate and energy agenda and accelerated the deployment of clean technologies. However, they also exposed rifts within and between EU Member States. At the same time, rampant forest fires, scorching heat waves, as well as widespread droughts and floods have made the growing impacts of the climate crisis tangible to European citizens.

Where does this leave the climate and energy agenda ahead of the next European Parliament elections and what should the European Commission do in its next mandate to advance the continent-wide transition to climate neutrality?

The policy context is different today than in 2019

Looking ahead to the next EU policy cycle, the context for climate and energy policy in Europe is different today than it was in 2019, and in part more challenging:

→ **The EU is stretched institutionally.** Russia's war against Ukraine has put EU accession of Ukraine – a country of 37 million people before the war with an estimated GDP per capita of less than half of Bulgaria, and a huge agricultural sector – high on the political agenda and with it

the ongoing accession process of the six Western Balkan countries (Albania, Bosnia and Herzegovina, North Macedonia, Kosovo, Montenegro and Serbia). In December 2023, EU leaders decided to open accession negotiations with Ukraine and Moldova and to grant candidate status to Georgia. The strategic and security motivations behind a further expansion of the EU are clear. But it could well overstretch the Union as it currently is, while a further development of the EU institutions would tie up much political energy and carry significant political risks.

→ **The EU is stretched financially.** The Covid pandemic, the energy price crisis and humanitarian and military support to Ukraine required hundreds of billions of euros in unforeseen public funding and pushed several Member States beyond sustainable debt limits under the EU fiscal pact. Increased inflation has been easing the relative weight of public debt on government budgets. However, the expected drop in available EU funding, from a combined 1.85 trillion euro EU budget for 2021–2027¹ to a "normal" EU budget as of 2028, suggests that it will be challenging for several Member States to offer sufficient support for the build-out of clean energy infrastructure, for home renovations, for the replacement of fossil heating systems or old cars, for regions phasing out coal mining, etc. At the same time, the outlook for the next EU budget period is characterised by much higher borrowing costs compared to 2019, which will increase demands for public programmes that facilitate access to finance through soft loans, guarantees and other financial support instruments.

¹ That is EUR 1.1 tn Multiannual Financial Framework plus EUR 750 bn recovery budget "Next Generation EU".

- **EU and national climate policy will affect the lives of citizens more directly.** New EU climate laws, particularly the expanded system for greenhouse gas emissions trading, will see more citizens directly affected by climate policy. While an EU-wide price on greenhouse gas emissions will drive cost-cutting innovation and enable new business models, it will also increase costs for households and businesses that are unable to replace climate polluting technologies with clean alternatives. Demand for public support for green investments will hence rise significantly. This means the EU should continue to invest in green R&D and maintain the fiscal space of governments to support private investments into the green transition through grants, preferential loans or financial de-risking. An insufficient pace of investments into clean technologies would likely translate into very high carbon prices that could well erode public support for the transition.
- **Security and resilience concerns have moved centre stage.** Europe's transition to climate neutrality requires a fast increase in the annual deployment of clean technologies, in particular solar PV, onshore and offshore wind, batteries, heat pumps and electrolysers. However, the pandemic, Russia's war against Ukraine and rising trade tensions between the US and China demonstrate that Europe cannot take the smooth functioning of international cleantech value chains for granted. Efforts to de-risk current industrial value chain dependencies and enhance the resilience of Europe's energy transition have thus moved centre stage. Similarly, the agriculture and food sector is discussing efforts to strengthen 'open strategic autonomy' by reducing reliance on the import of key farm inputs (e.g. fertilizer and feed).
- **The EU faces strong competition for green markets and a challenge to the global trade order.** The vision of a green, competitive industry in Europe with highly qualified and well-paid jobs that build on a vibrant network of innovators is at the heart of the EU Green Deal project. However, Europe's implicitly assumed green-technology leadership is challenged through green industry initiatives of key competitors such as China and the US and an eroding rules-based international trading system.
- **Climate policies have become mainstream but are losing momentum.** In the run-up to the 2019 European elections, the Fridays for Future movement made accelerated climate action into a central political issue. Five years on, polling shows broad public awareness of the climate crisis and continuously high demand for effective climate action. At the same time, political support for new and more far-reaching climate policy initiatives seems to be eroding. This reflects both a push-back of incumbent interests in a fossil-based energy system as well as the fact that deeper cuts in greenhouse gas emissions will more directly affect the lives of citizens and thus need to relate to widely different social and economic interests.
- **Increasing physical and economic impacts of the climate crisis raise the importance of adaptation.** Flash floods, heat waves and droughts as well as widespread forest fires make the climate crisis increasingly visible in the lives of EU citizens and impair the productivity and resilience of ecosystems, which are critical for agriculture, forestry, and carbon management; and these impacts will get worse. The European Environment Agency estimates that extreme weather and climate events caused 59.4 billion euros and 52.3 billion euros of economic losses in 2021 and 2022, respectively, compared to an average of 12 billion euros per year from 1980 to 2022². The growing visibility of the impacts of the climate crisis underscores the need for stronger climate action as only the rapid transition to net-zero greenhouse gas emissions will stabilise the situation. At the same time, the inevitable effects of the climate crisis will demand increasing attention to adaptation measures, to reduce the risk of fires, to manage scarcer freshwater resources, or to avoid extreme heat in urban environments. Politically, it will be important to avoid that increasing political and economic resources for climate change adaptation will crowd out measures to rapidly reduce greenhouse gas emissions.

² European Environment Agency (2023a).

The Fit for 55 package initiates the transformation in all sectors

EU climate action in the 2024–2029 policy cycle can build on major achievements of the European Green Deal. The EU Climate Law sets legally binding targets to cut emissions by at least 55 percent by 2030 relative to 1990 levels and to reach climate neutrality continent-wide by 2050. The Fit for 55 package

translates this ambition for 2030 into specific climate and energy targets and measures, and establishes several sectoral and technology-specific policies, such as CO₂ standards for cars and trucks or efficiency requirements for the buildings stock. These policies both complement and reinforce the overarching climate and energy targets as they accelerate action on the ground (see Table 1).

Overview of headline climate and energy targets in the Fit for 55 package

→ Table 1

Climate	Other
<p>Revised EU economy-wide climate target:</p> <ul style="list-style-type: none"> → 55 percent net GHG emission reductions by 2030 (vs 1990 levels) <p>Revised ‘ETS 1’ emissions trading system for power, industry and bunker fuels, and a new anti-‘carbon leakage’ instrument (CBAM):</p> <ul style="list-style-type: none"> → 62 percent emission reductions by 2030 vs 2005 levels → Accelerated phase-out of free allowances for installations at risk of ‘carbon leakage’ and the parallel introduction of a new ‘Carbon border adjustment mechanism’ to address embodied emissions for select products → Expanded scope to include CO₂ emissions from maritime transport from 2024, and CH₄ (methane) and N₂O (nitrous oxide) as of 2026 → Potential scope extension for international aviation, non-CO₂ emissions in aviation and waste incineration → EU-wide emissions cap (no national targets) <p>New ‘ETS 2’ emissions trading system for transport, buildings, and small industry installations:</p> <ul style="list-style-type: none"> → 42 percent emission reductions by 2030 vs 2005 levels → EU-wide emissions cap (no national targets) <p>Revised ‘Effort Sharing’ targets for transport, buildings, agriculture, small industry, waste:</p> <ul style="list-style-type: none"> → 40 percent emission reductions by 2030 vs 2005 levels → National targets ranging from -10 percent to -50 percent 	<p>Revised CO₂ standards for cars and vans:</p> <ul style="list-style-type: none"> → Targets to reduce 55 percent of CO₂ emissions for new cars and 50 percent for new vans from 2030 until 2034, and for 100 percent CO₂ emissions reductions from 2035 for both new cars and vans <p>New ReFuelEU Aviation Regulation:</p> <ul style="list-style-type: none"> → Obligation on EU airports and fuel suppliers to ensure that fuel available to aircraft operators contains at least 2 percent Sustainable Aviation Fuels from 2025 onwards, increasing every five years and reaching 70 percent in 2050 <p>New FuelEU Maritime Regulation:</p> <ul style="list-style-type: none"> → Limits on the GHG intensity of the energy used on-board large ships, decreasing by 2 percent in 2025 and 6 percent in 2030 and 80 percent by 2050 <p>Revised Energy Performance of Buildings Directive:</p> <ul style="list-style-type: none"> → Obligation for all new residential and non-residential buildings to have zero on-site emissions from fossil fuels, as of 2028 for publicly-owned buildings and as of 2030 for all other new buildings → National trajectories to reduce the average primary energy use of residential buildings by 16 percent by 2030 and 20–22 percent by 2035 → Minimum energy performance standards for non-residential buildings to renovate the 16 percent worst-performing buildings by 2030 and the 26 percent worst-performing buildings by 2033 → Gradual solar obligation for new and existing public and non-residential buildings from 2027 → No subsidies for the installation of stand-alone fossil-fuel boilers from 2025

Climate	Other
<p>New land-use, land-use change and forestry (LULUCF) GHG emissions targets:</p> <ul style="list-style-type: none"> → 310 Mt CO₂eq net removals by 2030 → National targets ranging from -39 Mt to +0.4 Mt CO₂eq 	
Renewables	Energy Efficiency
<p>Revised Renewable Energy Directive:</p> <ul style="list-style-type: none"> → 42.5 percent renewable energy share of gross final energy consumption in 2030 – with potential to increase to up to 45 percent; each Member State will contribute to the collective delivery of this EU-wide target with a contribution to be included in its updated National Energy and Climate Plan (NECP) → Buildings: indicative renewable energy target of 49 percent by 2030 → Transport: binding 14.5 percent greenhouse gas intensity reduction or 29 percent share of renewable energy in final energy consumption → Transport: binding combined sub-target of 5.5 percent for advanced biofuels and Renewable Fuels of Non-Biological Origin (RFNBOs), with a minimum requirement of one percent RFNBOs → Industry: indicative 1.6 percent annual increase in renewable energy in final energy consumption → Industry: binding target of 42 percent of hydrogen to come from renewable fuels of non-biological origin by 2030 and 60 percent by 2035 	<p>Revised Energy Efficiency Directive:</p> <ul style="list-style-type: none"> → Binding final energy consumption target of 763 Mtoe in 2030 and indicative primary energy consumption target of 992.5 Mtoe in 2030; each Member State will contribute to the collective delivery of this EU-wide target with a contribution to be included in its updated NECP → Increasing annual energy savings obligation from 0.8 percent (at present) to 1.3 percent (2024–2025), then 1.5 percent (2026–2027) and 1.9 percent from 2028 onwards; an average of 1.49 percent of new annual savings for the period from 2024 to 2030 → Annual energy consumption reduction target of 1.9 percent for the public sector as a whole → three percent renovation rate for public sector buildings

Agora Energiewende (2024)

The Fit for 55 package initiates a fundamental transformation in nearly all sectors. Effective implementation of the package would see the share of renewable energy in the EU power sector increase to around 70 percent by 2030 and a phase-out of coal use around 2035. The new CO₂ standards for cars could see the sale of internal combustion engine passenger vehicles decline to zero by 2035; additional standards for heavy duty vehicles could see new truck fleets largely decarbonised by 2040. Stationary emissions of energy-intensive industry will reach zero by 2039, as a consequence of the reformed EU emissions trading system. Renovation of Europe’s building stock will accelerate and by 2040 heat pumps and renewables-based district heating systems should have largely replaced fossil boilers.

EU climate and energy laws require a significant acceleration of greenhouse gas emissions reductions, renewable energy deployment and energy efficiency improvements over this decade compared to historical trends. At sectoral level, the steepest overall emissions reductions should happen in the power sector, driven primarily by the scaling of renewables and the phase-down of coal-based power generation. However, compared to past efforts, the most significant acceleration must occur in the buildings, transport and land-use sectors (see Figure ES below).

The *Trends and Projections in Europe 2023* report of the European Environment Agency indicates that the EU is currently not on track for achieving its

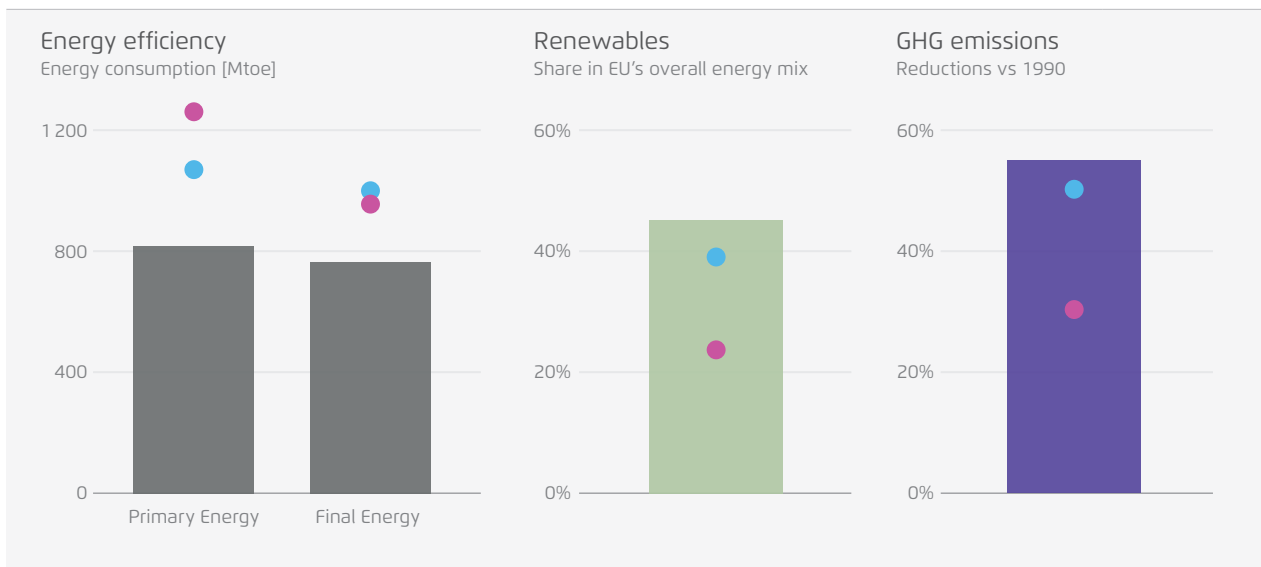
2030 climate target³. Policies and measures currently in place or under preparation would achieve only 48 percent net greenhouse gas emissions reductions by 2030 relative to 1990 levels, leaving a gap of 7 percent. A significant 'delivery gap' currently also exists

for both the EU energy efficiency and renewable energy targets. Progress also varies from a geographic standpoint, with net greenhouse gas emissions even rising in several countries. Moreover, the decline in ecosystem services poses a grave challenge to both climate change mitigation and adaptation, and none of the targets on biodiversity monitored by the report

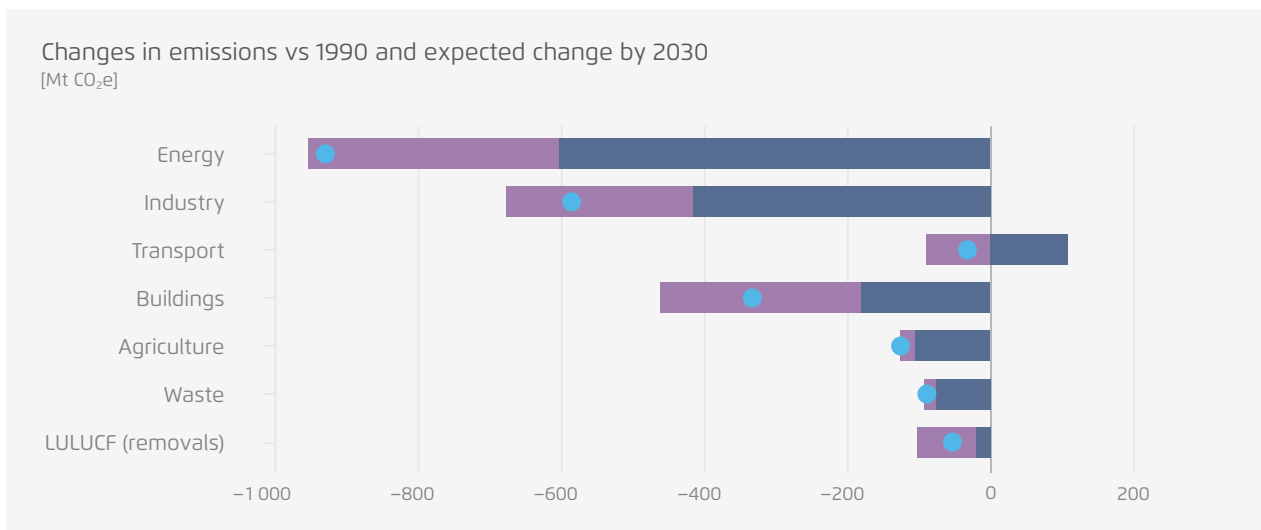
3 European Environment Agency (2023b).

The EU Green Deal delivery gap: EU climate and energy targets vs past and future trends

→ Fig. ES



● NECPs estimate ● 2022 ● EED 2030 target ● RED 2030 target ● GHG 2030 target



● 1990-2030 MIX scenario ● 1990-2021 ● Member State projections

Agora Energiewende (2024). Data from EC (2023a) and EC (2023b). Note: EED: Energy Efficiency Directive. RED: Renewable Energy Directive. NECPs: National Energy and Climate Plans. MIX scenario refers to the European Commission's core policy scenario underpinning the 2030 Climate target plan.

are likely to be met by 2030. The 'EU Climate Action Progress Report 2023' of the European Commission therefore concludes that additional climate action is needed in all sectors, particularly in transport, buildings and the land-use sectors. At the same time, the need for additional climate measures should not hide the real progress made. Two years ago, governments planned for only 41 percent greenhouse gas emissions reductions. Furthermore, the energy (price) crisis sparked major investments into renewable energy and energy efficiency:

- 2022 saw record high wind and solar installations (around 60 GW) and a new record share of renewables in the power sector (40.7 percent)
- 2022 also saw a record-high deployment of heat pumps with 3 million units sold, an increase of 37 percent
- In 2022, electric cars sales reached a share of 21.6 percent, while the availability of publicly accessible chargers surged by more than 50 percent compared to 2021.

Effective implementation of the Fit for 55 package will further accelerate this good progress.

Policy making for post-2030 will be different from pre-2030

Implementation of the Fit for 55 package will be a major focus of the next European Commission. However, the Commission also needs to consider new initiatives for the post-2030 period. Most prominently, the EU Climate Law obliges the Commission to propose an EU climate target for 2040.

The 2040 emissions reduction target is an important milestone on the EU's pathway to climate neutrality and will provide an important benchmark for governments, industry and citizens when deciding on investments into clean technologies and infrastructure planning.

In 2020, European Commission modelling identified an 86.4 percent greenhouse gas emission reduction for 2040 as cost-effective benchmark between the

2030 climate target and climate neutrality by 2050⁴. A recent Agora Energiewende study⁵ found that based on latest technological progress, an EU greenhouse gas reduction target of 90 percent by 2040 is realistic. Moreover, the European Scientific Advisory Board on Climate Change found that staying within a recommended EU greenhouse gas emissions budget for the period 2030 to 2050 required emissions reductions of 90–95 percent by 2040⁶.

Several reasons suggest using the 2024–2029 policy cycle not only for setting the EU's 2040 climate target but also to develop complementary policy initiatives:

- From an investor and infrastructure planning perspective, early decisions on next steps in EU climate policies in industry, buildings or transport are as important as the overall ambition level of the 2040 climate target. If decisions on next steps are not taken in the next EU policy cycle, then additional measures cannot be adapted before 2031/32.
- In the next EU policy cycle governments and the Parliament will also decide on the EU's next multiannual budget that will likely run from 2028–2034. Clarity on climate and energy policy priorities beyond 2030 will be critical when deciding on the amount and on the priorities of EU funding to support the next steps in Europe's transition to climate neutrality, particularly in the transport, building and agriculture sectors, where implementation gaps are currently most concerning.
- Clarity on the EU climate and energy framework beyond 2030 and on available EU funding in support of climate-related investments will also be critical reference points for governments, when they prepare their National Energy and Climate Plans (NECPs) for 2030–2040.

New initiatives on post-2030 climate and energy policies will face several new challenges. To give some examples:

⁴ See European Commission (2020a), p. 128, Figure 20.

⁵ Agora Energiewende (2023a).

⁶ European Scientific Advisory Board on Climate Change (2023).

1. **The need to manage the ETS 'endgame':** The EU Emissions Trading System (EU ETS) was recently reformed as part of the Fit for 55 package and now also covers buildings and transport with consequences for the period after 2030. Most importantly, the cap on emissions for the two emissions trading systems is set to decrease to zero in 2039 (ETS I) and 2044 (ETS II), respectively. Emissions trading is thus expected to enter an 'ETS endgame' where the supply of emissions allowances approaches zero. What will be the impact on market liquidity? Will prices remain politically acceptable or become very volatile? Should the trading of negative emissions certificates be permitted for compliance? Should the two emissions trading systems be merged?
2. **Carbon leakage protection will need to evolve:** In the post-2030 era, carbon leakage protection is imperative as the EU transitions from free allocation to the Carbon Border Adjustment Mechanism (CBAM). While the CBAM addresses immediate concerns of European industry, it also creates political challenges internationally. The absence of internationally accepted approaches to carbon leakage protection creates legal and diplomatic ambiguities in a world of uneven climate policies. International cooperation is essential to balance objectives of carbon leakage protection with rules-based and fair international trade. Initiatives like the OECD climate club or the US-EU-led Global Steel and Aluminium Arrangement may constitute the potential nucleus of broader international cooperation but could also undermine effective global climate action.
3. **Difficult to avoid residual emissions will become dominant:** Currently energy-related emissions make up around 77 percent of EU greenhouse gas emissions. However, these will decline by more than 90 percent in all ambitious 2040 climate target scenarios. Accordingly, residual emissions in more difficult to decarbonise sectors like agriculture, waste, international shipping and aviation and certain industrial sectors, such as cement, will begin to dominate total greenhouse gas emissions in coming decades. Addressing these residual emissions will require the accelerated deployment of carbon removal technologies⁷, renewable hydrogen, biomethane, e-fuels as well as their associated infrastructure. These technologies will change the focus of climate action as decarbonisation becomes technically more difficult and more costly. In the same context, reversing the loss in natural carbon sinks and enhancing the carbon removal capacity of forests and soils will be critical.
4. **Distributional questions between EU Member States become more complex⁸:** Until now, the EU climate target architecture includes national targets for sectors not covered by emissions trading – the so-called "non-ETS" sectors. The national targets for 2020 and for 2030 are set according to the relative wealth measured in GDP per capita for each Member State. For both periods the chosen spread between targets for the low-income and high-income Member States is 40 percentage points. Bulgaria, for example, has a target of -10 percent, while Luxembourg has a target of -50 percent. This approach was initially chosen because per capita emissions in low-income Member States were lower, and to show solidarity. Closer to climate neutrality, this logic cannot continue since all Member States will need to reduce emissions as much as possible. Already under the current targets lower-income Member States could see higher per capita emissions by 2030 than the EU average. This will make their transition to climate neutrality after 2030 more challenging: instead of gradual reduction efforts these countries will need to undertake truly drastic changes.
5. **Successful climate policies change the fiscal revenue base:** In 2021, EU Member States collected 260 billion euros in energy taxes, equivalent to 1.76 percent of EU GDP and 4.32 percent of total government revenues⁹. These taxes are collected on the sale and consumption of fossil fuels and electricity; largely oil (>80 percent), followed by

7 Such as Bioenergy with CCS (BECCS) or Direct Air Capture and Storage of Carbon (DACCS).

8 Öko-Institut and Agora Energiewende (2020).

9 Eurostat (2023).

electricity, and gas¹⁰. As the EU economy reduces its reliance on fossil fuels, these tax revenues will decrease. This could raise fiscal challenges. We estimate that the projected decline in energy taxes could offset positive revenue effects of EU carbon pricing already in the 2030s, even when considering rising CO₂ prices.¹¹ This suggests that governments must explore new forms of fiscal revenues to ensure adequate funding for the transition.

6. Citizens are more directly impacted by EU

climate measures: The bulk of greenhouse gas emissions reductions since 1990 were achieved in the power and industry sectors, requiring relatively little behavioural change of citizens. By contrast, the necessary decarbonisation of the transport and building sectors in the coming decades will require households and businesses to invest into electric heat pumps or electric vehicles that have higher up-front costs compared to their fossil alternatives. Many house owners will need to undertake some energy efficiency renovation or may need to decide whether to connect to a district heating system or not. The switch to electric vehicles comes with changing habits of charging. Households that continue to use fossil fuel cars and heat appliances will see increasing fuel costs due to carbon pricing. Overall, vulnerable and low-income households will require some financial support to ensure the affordability of low-emission heating and mobility options, such as heat pumps or electric vehicles. Likewise, further efforts are needed to better define, monitor, and tackle food poverty to ensure that all consumers can have access to healthy and sustainable diets.

7. Improving the climate performance of the agri-food system and forestry is a key challenge: The agricultural sector is currently the largest greenhouse gas emitting sector without a dedicated climate target or measures to reliably reduce sector-specific emissions. With climate neutrality approaching, agriculture will need a coherent set

of incentives to support its climate change mitigation potential. The design of such a framework raises many questions. More comprehensive carbon pricing will be needed, for example through inclusion in emission trading, which could open a pathway for effective emission reductions while using revenues to support the just transformation of the sector. Another aspect is how to design incentives for land-based carbon removals so they can provide viable earning opportunities in forestry and agriculture, while maintaining climate integrity. Moreover, an effective climate governance framework will need to be accompanied by a policy mix that also supports other sustainability dimensions, such as biodiversity and the adaptation to climate change.

8. Clean technologies will need to scale at break-neck pace, while the downsizing of fossil fuel infrastructure begins:

In the 2030s, the energy sector enters a period of 'mid-transition'. The deployment of clean technologies (e.g. wind, solar, electric vehicles, batteries and heat pumps) will further accelerate but still be insufficient to meet all energy and mobility services consumers demand. Meanwhile, incumbent fossil industries and infrastructures will face the challenge of adapting to a net-zero future or exiting the market. As a result, carbon-based infrastructure will begin to shrink under regulatory and competitive pressure, risking rising prices and potentially the disruption of some fossil fuel-based products and services. Proper forward planning will be essential to successfully manage this transformation.

9. The role of adaptation to the changing climate will become more prominent: In the post-2030 period, climate and energy policymaking in the EU is poised for a profound shift, driven by the escalating visibility and tangibility of the impacts of a changing climate. Even if we were to halt all emissions today, some degree of climate change is already locked in, and the impacts of a changing climate are set to increase further before the world reaches climate neutrality. Adaptation to a changing climate will become more prominent and integral to strategies for mitigating greenhouse gas emissions. This is particularly the case in the land-use sectors, where climate adaptation

¹⁰ European Commission (2020b).

¹¹ Agora Energiewende (2024 forthcoming).

will become a precondition for climate change mitigation especially in forestry. However, the thinking together of mitigation and adaptation will also become relevant for building renovations or infrastructure planning.

- 10. The energy transition and climate change will begin to (re)shape geopolitics:** The transition from fossil fuels to clean technologies such as renewables and electric vehicles will alter the global economy, not least because of resulting changes in the structure of international trade and capital flows. Oil and gas producing countries will likely experience declining demand, while the world economy will see increased trade in renewable energy, clean technologies (e.g. electric vehicles), critical minerals and the intermediate goods and industrial equipment needed to produce or refine them. However, since countries producing fossil fuels are generally not the same as those producing clean technology, and renewable energy is available in all countries, the different trends are unlikely to compensate each other¹². These changes in trade patterns could

result in political tensions as fossil fuel producers aim to safeguard shares of declining markets. Recent political developments, such as the EU Carbon Border Adjustment Mechanism and the US Inflation Reduction Act, have also put a spotlight on the cross-border impacts of climate policy and the increasingly competitive global race for leadership in markets for clean technologies. Meanwhile, the increase in human suffering and economic damage from climate change-related events risks diverting attention and resources away from collaborative global efforts to reduce greenhouse gas emissions. Striking a delicate balance between addressing immediate impacts and fostering international cooperation will be paramount for EU policymakers in the post-2030 period.

¹² International Monetary Fund (2023).

2 20 policy initiatives to advance solidarity, competitiveness, and sovereignty

The remaining part of this paper sets out 20 policy initiatives that the next European Commission should consider for its work programme on climate and energy policy. We cluster the proposed initiatives as follows:

- Fostering public support and active engagement
- Greening Europe's industrial base while strengthening competitiveness and resilience in strategic clean technology
- Scaling clean power and net-zero infrastructure
- Scaling climate investments while preserving the sustainability of public debt and a functioning single market
- Closing policy gaps
- Adapting to a changing geopolitical landscape



Fostering public support and active engagement

The impacts of the climate crisis will increasingly affect the livelihoods of Europeans. A rapid transition to a climate-neutral economy is the only way to stop impacts from growing to a level that could overwhelm societies and economies. The transition will change the way we heat our homes, the cars we drive, the skillsets that secure employment, some landscapes, and partially how we eat. Broad public support of the necessary shifts and the active engagement of citizens is essential for the success of the transition.

The push-back against recent climate policy initiatives, for example against the proposed shift to climate-neutral heating systems, has shown that public support and active engagement must be won for climate policy as much as for any other policy initiative that directly affects the lives of citizens. Clean technologies and sustainable practices can be expensive, posing a financial barrier for some individuals and businesses. They can also lead to concerns about social justice and equity where climate policies disproportionately affect certain socio-economic groups. Rural areas face different challenges and priorities compared to urban centres, creating a potential rural-urban divide in the support for climate policies that is beginning to manifest at the ballot box. Moreover, the spread of misinformation and disinformation can distort public perceptions and fuel resistance to climate policies. The following policy initiatives would address these challenges.

Initiative 1: Make clean heating and cooling affordable and accessible

Why this is important

Private investments in heat pumps and building renovation rose sharply during the energy crisis, with sales of heat pumps increasing by nearly 40 percent

in 2022. This highlights that heat pumps already represent mature and attractive options for many EU citizens today. In addition to increasing comfort at home, such investments play an important role in safeguarding against price volatility and energy

poverty. According to one report, European households with solar photovoltaics (PV) and heat pumps installed in Germany, Spain and Italy saved up to 3 700 euros or 84 percent on their household bills in 2022 compared to homes relying on gas heating and without solar panels.¹³

However, the high upfront investments remain a serious barrier to their diffusion for at least six reasons. Firstly, in most cases, European households still have to finance these investments from their own savings because credit availability from banks or suppliers is limited, and innovative financing schemes like on-bill financing or lease products are currently still rare. Secondly, where building owners have access to consumer financing, the high upfront costs are a significant disadvantage in the current high-interest-rate environment. Thirdly, in some Member States, high upfront costs are compounded by elevated electricity prices relative to fossil fuels, resulting in long payback periods for heat pump investments. Fourthly, in some regions of Europe, buildings have relatively low market value, meaning that high energy renovation costs can constitute a large share or even exceed the total value of certain properties. Fifthly, even when life cycle costs are advantageous, private consumers often do not conduct full life-cycle cost assessments but instead focus strongly on upfront costs. And finally, in case of rented buildings, a split incentive dilemma arises as the building owner bears the upfront cost while fuel costs are shouldered by the tenants. Given this myriad of factors, consumers do not always see a financial benefit from switching to cleaner heating options, and such investments are often perceived as prohibitively expensive by building owners and creditors, even when investment subsidies are taken into account.

At the same time, affordable heat pumps and building renovation services are not always available. Supply chain constraints due to COVID-19 disruptions, tight labour markets, skills shortages, and the sudden spike in demand for heat pumps and building renovation

during the ongoing energy crisis have meant that households often found it difficult or even impossible to obtain an affordable offer, let alone find an available heating installer or construction company. Despite significant new investments by the heat pump industry, heat pump sales then slowed in 2023 due to decreasing gas prices and an uncertain regulatory environment.

These economic and market barriers mean that many households and small businesses risk being locked into dirtier fossil technologies in the coming years, while clean heating and building renovation supply chains fail to scale to the necessary levels to deliver on the EU's climate and energy targets. This state of affairs is particularly problematic given the accelerating climate crisis and the introduction of a new EU emissions trading system for buildings and transport (ETS 2) from 2027. This system will increase energy costs for those locked into fossil fuel-based technologies, potentially disproportionately impacting low-income households and tenants.

Against this backdrop, additional policies are needed to ensure the affordability and availability of clean heating for all, and in particular for low-income and vulnerable households.

What needs to happen

1. **Present the Heat Pump Action Plan without further delay:** In 2023, the European Commission carried out extensive stakeholder consultations on a Heat Pump Action Plan aimed at expediting heat pump deployment in the EU through four key components: (a) a heat pump accelerator to bring together stakeholders, (b) a dedicated heat pump skills partnership, (c) EU legislative initiatives, including stricter ecodesign standards for heating appliances, and (d) access to EU funding programmes. While originally scheduled for the first half of 2024, the European Commission has put the initiative on hold until after the elections for the European Parliament. As heat pump uptake begins to waver, the next European Commission

¹³ SolarPower Europe (2023).

must reaffirm the EU's commitment to achieving its REPowerEU heat pump targets by adopting the Heat Pump Action Plan without further delay.

2. **Make affordable heating and cooling a core element of the next work programme:** The next European Commission must also look beyond industrial partnerships to launch a citizen- and consumer-centric EU initiative that aims to expedite home energy renovation investments and reduces payback times for household consumers. Key action points include:

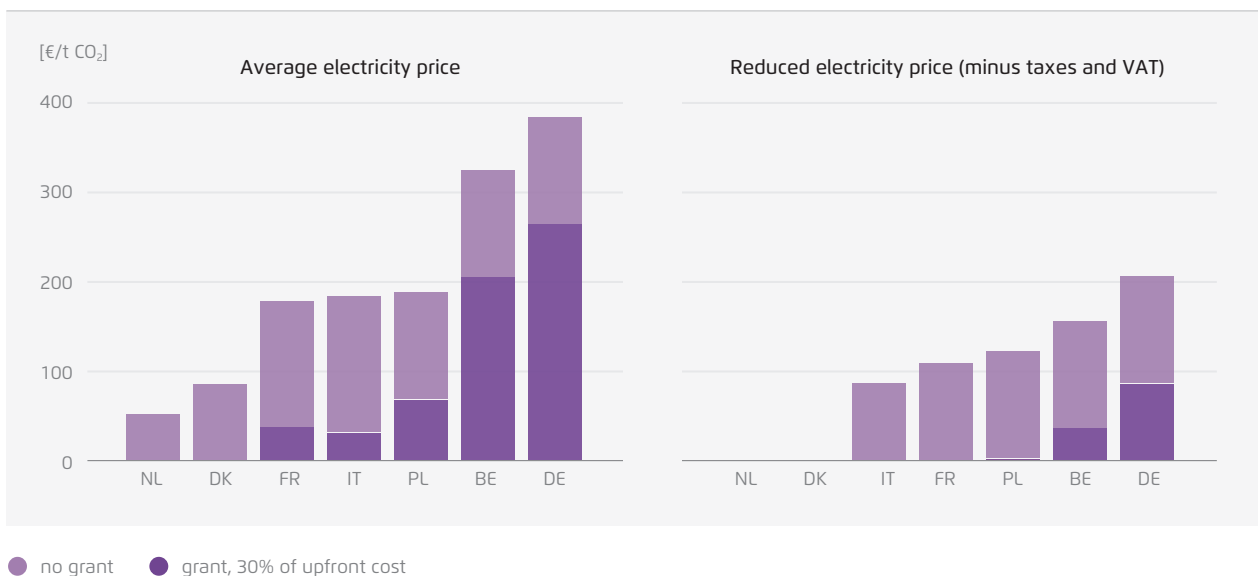
→ **Rebalancing the price ratio of fossil fuels vs electricity:** In order to support the direct electrification of heating with heat pumps, there is a critical need to rebalance retail electricity and fossil prices in select Member States. This will entail reforms in national taxes, network charges and surcharges, the scheduled introduction of the ETS 2 in 2027, and the immediate phasing out of remaining fossil fuel subsidies. The next European Commission should make energy price rebalancing a key focus of its action plan and its dialogue with Member States under existing EU monitoring and

governance frameworks (e.g. National Energy and Climate Plans (NECPs), the State of the Energy Union Report, the European Semester, as well as National Building Renovation Plans (NBRPs)).

→ **Providing targeted support for the transition to clean heating to low-income households:** The ownership structure for the residences of low-income households differs widely across Member States, ranging from largely self-owned properties (Southern Europe), to rental properties (Germany) and social housing (Netherlands). In each of these cases, Member States should establish home renovation programmes specifically tailored to low-income households. For self-owned properties and small private landlords, a common feature should be public support for upfront costs through a combination of grants and loans, with grants covering a large share of the expenses for very low-income households. Financial support should also be made more accessible for low-income households by simplifying eligibility criteria and ensuring the

Additional CO₂ price needed for a heat pump investment to break-even in ten years at December 2023 fossil gas prices

→ Fig. 1



Agora Energiewende (2024), based on Household Energy Price Index (HEPI) data. Note: Calculations assume an investment cost differential of € 7 500 between the gas boiler and the heat pump across all countries, while gas and oil consumption are differentiated by Member State. Calculations based on a ten-year period. The reduced electricity price is calculated as the average electricity price minus taxes and VAT.

support is available upfront. Finally, housing companies should be targeted via a combination of regulation (e.g. minimum energy performance standards, MEPS), laws that protect tenants, and, where necessary, specific financial support. The Social Climate Fund (SCF) and revenues from the newly established ETS 2 can be a key source of revenue for Member States to support households. The national social climate plans to be submitted to the European Commission by 30 June 2025 should reflect this.

- **Providing access to low-interest loans to all households:** In the current high-interest environment, the provision of low or zero-interest public loans can play a key role in facilitating renovations for households that are not at risk of poverty but still lack the financial means to carry out costly investments. The European Investment Bank (EIB) and national development banks can play an important role in derisking such loans, especially in the case of “unbankable” customers, such as elderly pensioners for whom private banks are currently often unwilling to take financial risks by extending a credit.
- **Fostering innovative finance and business models:** Market-based solutions to make clean heating affordable (e.g. heat pump lease

contracts, on-bill financing, and smart electricity pricing) are essential complements to government-backed instruments. They limit household costs and reduce public funding requirements. The European initiative should identify the barriers to their development across Member States, from regulatory framework to economic fundamentals, and make efforts to provide the framework conditions needed to support their diffusion.

3. **Set a new EU clean heat standard to scale heat pump supply chains:** The EU should consider setting a new clean heat standard, analogous to CO₂ standards for cars and trucks and similar to the UK Clean Heat Market Mechanism. This EU clean heat standard would compel fossil boiler manufacturers to sell a minimum share of heat pumps and other clean heating appliances that would increase over time. This obligation could be aligned with the EU’s REPowerEU heat pump target and the goal laid down in the Energy Performance of Buildings Directive (EPBD) of a complete phasing out of fossil fuel boilers by 2040. In addition to providing investment certainty for heat pump manufacturers, this instrument would help scale clean heating supply chains in line with the EU’s climate and energy security goals, drive down the cost of heat pumps, and promote the training of installers specialised in heat pumps.

Initiative 2: Provide affordable electric and shared mobility options

Why this is important

The decarbonisation of transport in Europe is entering its most important phase yet. While the general policy measures have already been put into place – notably the Effort Sharing Regulation (ESR), ETS 2, electrification targets for cars, vans, busses, and (soon) trucks, as well as regulation on charging infrastructure – everything will be put to the test during the upcoming five years. The success or failure in meeting these targets will show if we are indeed on the path to Paris when it comes to transport emissions in Europe – or not. One of the key challenges for the

next Commission is therefore in making the transport transformation in Europe a success. This is especially true given that the implementation of the ETS 2 will progressively increase the CO₂ price on fuel. EU citizens have two main ways to respond to this – switch cars (to more fuel-efficient and/or electric models) or switch transport modes. The first is hampered by the lack of affordable electric cars to date, the second by the lack of sufficient public transport options. Accelerating the transformation of the transportation sector thus essentially means ensuring the successful implementation of the above-mentioned laws, staying the course during their upcoming reviews, and a

much closer cooperation with Member States. This collaboration is vital to ensure that they provide the infrastructure as well as affordable options for people to electrify their car or to switch to public transport.

Replacing internal combustion engine (ICE) cars with electric vehicles is the single most important measure to bring down CO₂ emissions in transport, to help Member States achieve their respective national ESR targets, and to provide investment and planning certainty to the actors delivering change on the ground. Therefore, it is essential that the Commission reconfirms its 2035 target to phase out ICE. This development is driven by the CO₂ regulation for new vehicles setting targets for 2025, 2030 and the ICE phase-out target in 2035. However, the 2030 targets in the same regulation are currently not stringent enough for Member States to reach their 2030 ESR targets. In addition to that, it does not currently set annual interim targets but instead relies on stepwise targets with five-year intervals in between. The Commission should use the upcoming review to strengthen the 2030 target and to introduce yearly targets to make it easier to meet the important 2035 phase-out deadline for combustion engine cars.

National tax systems are another important instrument to reduce overall emissions from the car fleet and to incentivise the adoption of smaller and more energy-efficient vehicles. This is an aspect that the CO₂ regulation for cars has not adequately addressed since the introduction of the first limit values in 2015. In fact, the European Court of Auditors recently concluded that technological progress in terms of engine efficiency for petrol and diesel cars has been outweighed by increased vehicle mass (about +10 percent on average) and more powerful engines (+25 percent on average)¹⁴. Financial incentives can also help to make electric cars more affordable. France for example is currently considering the instrument of “social leasing”, a government-subsidised leasing scheme for low-income households. Several Member States already offer electric vehicle

incentives in their national tax systems. However, in many cases, these incentives could be considerably strengthened and better targeted to support the adoption of low-cost electric vehicles.

With regards to public transport, car dependency in the EU is high – travel by bus, tram, metro, and rail only accounted for less than 15 percent of motorised passenger transport. This is to a large extent due to insufficient supply of public transport options. An effective instrument to address this issue would involve implementing minimum supply standards for public transport. These standards could serve as guidelines for Member States to shape national policy decisions on public transport as well as high-light priority areas for EU funding. This approach is equally relevant for rail transport. The Commission should work with the Member States to ensure that especially passenger rail services are strengthened, thereby offering more and improved travel options by train. International connectivity is also important in the digital realm. It is high time to introduce unified ticketing systems as well as passenger rights that allow for streamlined booking processes, the right to board the next train without additional charges, and harmonised passenger rights across the EU.

What needs to happen

1. **Strengthen the 2030 CO₂ target for passenger cars and introduce yearly targets to help meet the important 2035 phase-out deadline for combustion engine cars:** The CO₂ regulation for cars will be reviewed in 2026 and potentially revised, an opportunity to strengthen the law. In any case, the 2035 target should be reconfirmed. In addition to that, the European Commission should propose efficiency standards for electric cars that combat the size and weight inflation of cars. These standards should ensure the introduction of more energy- and resource-efficient electric cars into the market.
2. **Create a scoreboard for Member States’ car taxation policies:** The European Commission should introduce a ranking of the performance of fiscal systems in terms of their support for

¹⁴ European Court of Auditors: *Reducing cars’ emissions: easier said than done*, 24/01/2024, <https://www.eca.europa.eu/en/news/NEWS-SR-2024-01>

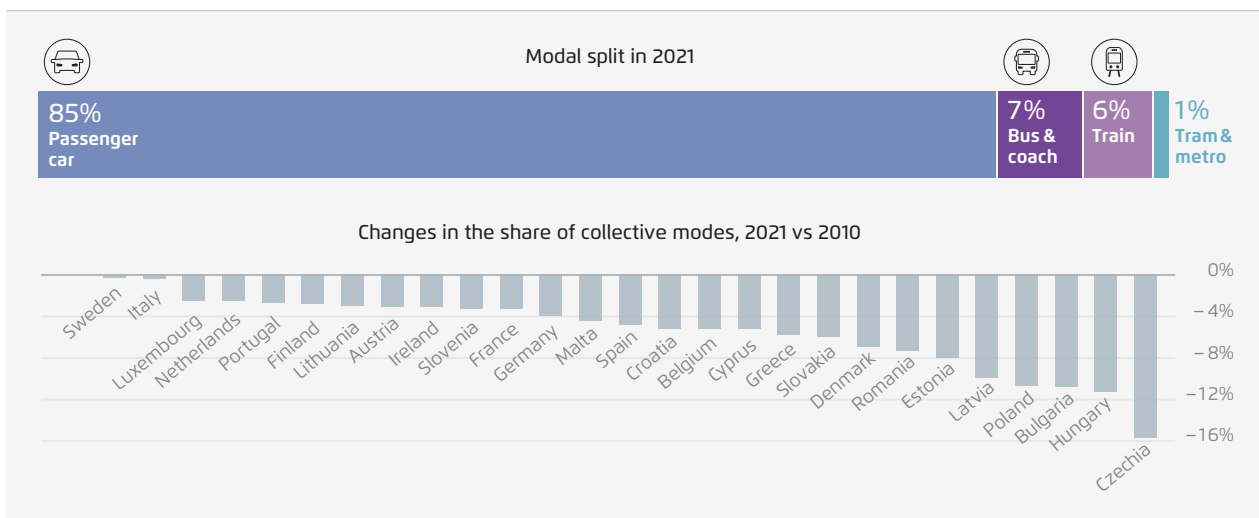
electrification. This could consider elements such as introducing or strengthening bonus-malus schemes, creating fiscal incentives for small electric cars, the instrument of “social leasing” for electric vehicles, and a reform of company car taxation to increase the tax burden on cars with an internal combustion engine. Such reforms would help Member States meet their national ESR targets and would create more favourable conditions for individuals to consider buying electric cars.

3. **Propose EU-wide minimum supply standards for public transport:** Some EU Member States are already pursuing or discussing minimum standards for the provision of local public transport (AT, DE). Similar measures should be proposed at the EU level while taking into account the varying conditions across Member States in terms of population density and geographic location.
4. **Develop a vision for a trans-European passenger rail network with many regular and direct connections between major European cities, including night connections linked to an integrated synchronised timetable:** As a first step, the Commission should ensure the full implementation of the Action Plan to boost long-distance and cross-border passenger rail services, with a focus on strengthening

international and cross-border train connections and a specific focus on night trains. It should also encourage Member States to reduce VAT and track access charges for night trains, many of which run on international routes and provide a more sustainable alternative to intra-EU flights.

5. **Ensure adequate funding from and of the Connecting Europe Facility (CEF) for rail projects:** EU policymakers should prioritise railway transportation when developing and evaluating sustainable transport strategies and ensure adequate funding for rail infrastructure projects in the CEF. This funding should be allocated with priority given to resolve delays in implementing the Trans-European Transport Network (TEN-T) Regulation, as well as to rail network expansion and maintenance.
6. **Adopt a multimodal digital mobility services regulation:** The Commission should adopt a multimodal digital mobility services regulation to promote seamless multimodal travel experiences by fostering the digitalisation of railway services and ensuring easier international ticketing across transport modes. Important measures to be addressed include implementing journey continuation, unified ticketing systems, and data sharing between different modes of transport.

Modal split of inland passenger transport in 2021 and changes in the contribution of collective transport modes to inland passenger transport between 2010 and 2021, EU-27 → Fig. 2



Agora Verkehrswende (2023) based on the Statistical Pocketbook 2023, section 23, Directorate General for Mobility and Transport (DG MOVE), European Commission. Note: Modal split of passenger transport on land, passenger-km in percentage, EU-27, 2021. Percentage point variations in the share of collective modes (buses, trains, trams and metros) of total inland passenger transport activities by country, calculated as the difference between shares in 2010 and 2021.

Initiative 3: Initiate a European Rural Deal to support sustainable prosperity

Why this is important

Rural areas cover more than 75 percent of the EU territory, house over a quarter of the European population,¹⁵ and are home to agriculture and forestry, which are essential for achieving Europe's sustainability objectives. Rural communities have a central role to play in the transition to climate neutrality and, in principle, could stand to gain significantly from it. For instance, rural entrepreneurs could capitalise on the growing demand for biomass from a sustainable buildings sector or from industries substituting their fossil carbon inputs with biogenic carbon. There are opportunities to produce renewable energies, including solar, wind, and residue-based biogas. Farmers can respond to demands for nutritious foods, such as for more fruits, vegetables, and legumes, as well as for regional products. Eco- and agritourism can also provide significant income opportunities. Additionally, there is significant potential for actors in the land use sectors to deliver crucial public goods, such as biodiversity conservation and carbon sequestration.

However, in practice, many of these opportunities remain unfulfilled. Despite their diversity, rural areas share a common set of needs and structural challenges that have not been sufficiently addressed during the design and implementation of the European Green Deal. For instance, demographic factors and longer distances between settlements hinder the deployment of key infrastructures, such as high-capacity digital networks, which are key for the further development of many businesses in rural areas. The lack of incentives for electric vehicles as well as for frequent and accessible public transport poses challenges to the expansion of clean mobility systems. Coupled with increasing CO₂ prices, this can lead to higher transportation costs. Furthermore,

the expansion of wind and solar energy can alter the appreciation of local environments and contribute to higher land rents, placing increased pressure on agricultural producers. Accessing social services, such as healthcare, education, and cultural services is often more challenging in rural areas, especially in remote regions. Despite some progress, per capita GDP in rural areas remains substantially below that in urban areas,¹⁶ and rural communities frequently feel overlooked by policymakers in terms of policy priorities and investments. These and other factors contribute to a lack of confidence that climate policy and associated changes will manifest as tangible benefits for rural societies, resulting in an increasing rejection of the green transition.

Even though the particular challenges of rural areas are documented as part of initiatives such as the "Long-term vision for the EU's rural areas up to 2040" and are covered by instruments like the EU's cohesion policy, thus far, these challenges have not been addressed at the scale and with the urgency they warrant. The 2023 EU Council Conclusions on rural areas echo this sentiment by calling on the European Commission to consider initiating a comprehensive rural strategy.¹⁷ A high-level initiative such as a 'European Rural Deal' would add political momentum to the necessity of establishing favourable conditions for rural communities to realise tangible benefits from the transition to climate neutrality. Such an initiative would need to extend its focus beyond agriculture and forestry to encompass various aspects of rural life. It should set the right incentives to foster economic opportunities that align with a net-zero economy, promote the production

15 Eurostat (2022): Urban-Rural Europe – introduction, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Urban-rural_Europe_-_introduction#Introduction_to_territorial_typologies and European Commission, The EU Rural Vision, https://rural-vision.europa.eu/rural-vision_en (accessed 22 February 2024).

16 Eurostat (2022): Urban-rural Europe – economy, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Urban-rural_Europe_-_economy (accessed 22 February 2024).

17 Council of the EU (2023): *A long-term vision for the EU's rural areas: Council approves conclusions*, 20/11/2023, <https://www.consilium.europa.eu/en/press/press-releases/2023/11/20/a-long-term-vision-for-the-eu-s-rural-areas-council-approves-conclusions/>.

of public goods, and leverage investments to address some of the structural challenges faced by rural communities.

For instance, capitalising on opportunities arising from the transition to climate neutrality will involve investing into rural economic clusters and new value chains. While carbon-intensive production systems, such as animal production, may undergo significant changes in certain regions, there is great potential for the emergence of new value chains linked to evolving demand structures. This encompasses utilising paludiculture products in the construction industry or ramping up the production of fruits and vegetables, which offer high added value per hectare. In the bioeconomy, establishing rural economic clusters presents long-term opportunities and potential multiplier effects for local economies. Simultaneously, the transformation and diversification of business models, coupled with increased digitalisation, will necessitate acquiring new knowledge, skills, and, in some instances, implementing targeted labour transition arrangements. Enabling workers and entrepreneurs to benefit from this transition will be crucial for social cohesion and livelihood security. Similarly, efforts are needed to remove barriers hindering the entry of new participants into rural economies and to encourage generational renewal in the land use sectors.

Ensuring that environmentally sustainable business models provide a viable earning potential also entails improving the coherence of existing incentives. Rural land uses, including agriculture and forestry, could increasingly play a central role in the realisation of Europe's climate ambitions. Although agriculture will continue to emit greenhouse gases in the future, it has vast potential to reduce its emissions, enhance carbon sequestration, and contribute to a sustainable bioeconomy, while continuing to offer food for healthy and sustainable diets and help reverse the decline in biodiversity. However, these opportunities are not fully realised at present and the EU's current agricultural policy framework falls short of unlocking this potential. The current lack of coherence leaves farmers without the necessary signals to integrate sustainability goals and societal demands, such as

climate mitigation, biodiversity protection, and animal welfare, into their business models. This threatens public support for agriculture and exacerbates long-term insecurities among producers.

Rural areas are highly vulnerable to the escalating effects of climate change. Droughts, floods, storms, fires, heat waves, soil degradation, and water scarcity pose real risks for lives and livelihoods, can cause major economic losses, and disrupt carbon cycles. Consequently, climate adaptation becomes a necessary precondition for rural prosperity. This holds particularly true for forests, which are among Europe's primary carbon stocks and sinks. However, despite the urgent need to increase carbon removals, the sink capacity of forests has experienced a declining trend. European forests must be managed in a manner that preserves and enhances their ecosystem services, enabling them to contribute to the bioeconomy, to carbon management, and biodiversity conservation. This requires appropriate incentives.

Overall, the future of rural areas will largely hinge on their capacity to offer attractive living environments that enable communities to fully partake in the benefits of a society transitioning to climate neutrality. This entails improved access to social services, clean mobility, and healthy ecosystems. It also requires ensuring that as many rural residents as possible can participate in and influence the transformation of the energy system while benefitting from new value creation. In this context, it may be necessary to develop dedicated support schemes, such as for insulation and modernising heating systems, which may otherwise prove financially unviable in certain areas. Additionally, packages that combine support for rooftop solar with electric vehicles could be considered as part of these initiatives.

What needs to happen

1. **Initiate a European Rural Deal:** Drawing on the "EU's long-term vision for rural areas up to 2040" and accompanied by dedicated action on climate adaptation, the incoming Commission should launch a European Rural Deal as a transformative

political project with a focus on expanding rural opportunities arising from the transition to climate neutrality. This flagship initiative, accompanied by a road map with milestones and objectives, should be co-created with stakeholders and introduce a mix of supporting and coordinating measures around three priorities:

- **Create future-oriented economic opportunities**, including by leveraging both public and private investments into rural economic clusters and new value chains, while supporting the acquisition of new skills and facilitating the establishment of new and young entrants to the land use sectors and rural economies. This also entails rewarding farmers and foresters for producing public goods through a more targeted allocation of funds under the Common Agricultural Policy (CAP) (see further below) and other policies.
- **Support the development of infrastructure for the benefit of rural communities**, including high-capacity digital networks and clean mobility systems, such as public transport,

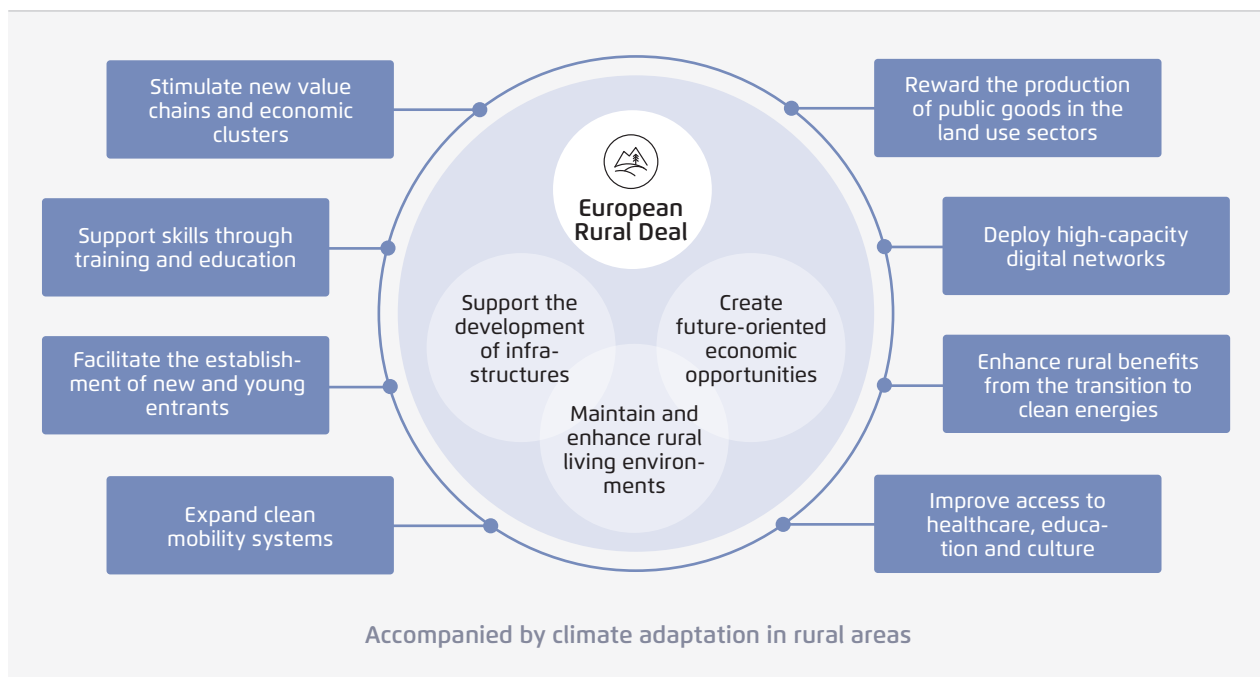
electric vehicles, and bike lanes. Implementing an EU-wide minimum supply standard for public transport (see priority 2 above) would support this objective. This also involves facilitating the expansion of renewable energies, accompanied by arrangements that enable rural communities to receive a share of the economic benefits of clean power generation.

- **Maintain and enhance the attractiveness of rural living environments** by facilitating access to social services, including healthcare, education, and culture. This could also involve introducing targeted programmes, including to support the modernisation of domestic heating systems and the combination of rooftop solar with electric vehicles. Similarly, the participation of local communities in renewable energy projects, as provided in the revised EU Renewable Energy Directive, should be ensured.

A European Rural Deal would not be a piece of legislation or a new fund. Instead, it would serve as a lighthouse project putting political priority on rural

A European Rural Deal: proposals to expand rural opportunities from the transition to climate neutrality

→ Fig. 3



Agora Agriculture (2024)

areas to guide the implementation of EU and national policies and funding instruments. It would enable EU institutions to assist and coordinate Member State efforts, ensuring that the transition to climate neutrality manifests as an opportunity for rural areas across the EU.

2. Revise the Common Agricultural Policy: The CAP is a major source of funding that can be deployed to support sustainable business models in the land use sectors. Revising the CAP for the period

after 2027 is critical to ensure the effective allocation of its budget towards creating earning opportunities for farmers from producing critical public goods, including nurturing biodiversity and managing carbon. Remuneration for these services would have to offer a reliable income potential. For the next EU financial period, the European Commission should come forward with proposals to this effect within the Multi-Annual Financial Framework (MFF) and the CAP.

Initiative 4: Combat misinformation about the climate crisis and available solutions

Why this is important

Public debates on the climate crisis often fail to grasp its urgency and are marked by disagreement regarding potential solutions, diverging significantly from expert assessments.¹⁸ In open democracies, achieving a minimum consensus on facts as well as the ability to distinguish between facts, opinions, and value judgements are critical prerequisites for making informed decisions on swift climate action. This becomes particularly paramount at a juncture when measures aimed at tackling the climate crisis are more directly affecting the daily lives of EU citizens (e.g. home renovations, lifestyle adjustments). Climate misinformation erodes the foundation of well-informed democratic decision-making on climate policies that match the gravity of the crisis we currently face.

These difficulties are exacerbated by the increasing fragmentation of public discourse, resulting from the proliferation of online social platforms such as Facebook, X (formerly Twitter), TikTok, or YouTube. A growing share of the population relies on these social media channels as their primary source of

news.¹⁹ There is extensive evidence indicating that social media use can undermine the legitimacy and effectiveness of political institutions.²⁰ Particularly concerning the climate crisis, there is well-documented evidence of the systematic dissemination of false or misleading information via social media (see figure 4). The emergence of AI-tools such as ChatGPT has the potential to supercharge the creation and dissemination of misinformation.²¹

The EU legislator recently enacted the EU Digital Services Act (DSA), which became effective on 16 November 2022, and has been directly applicable law in Europe since 1 January 2024. The DSA imposes specific obligations on providers of very large online platforms (VLOPs) and online search engines with an average monthly user base of at least 45 million. This includes platforms such as Facebook, Google Search, Instagram, LinkedIn, Microsoft Bing, Snapchat, TikTok, Wikipedia, X (formerly Twitter), and YouTube.

¹⁸ Experience with citizen assemblies shows that well-structured debates on the climate crisis in randomly selected, representative groups of citizens typically result in strong support for broad and rapid climate action. (See e.g. Giraudet, Apouey, et al. (2022), "Co-construction" in deliberative democracy: lessons from the French Citizens' Convention for Climate, <https://doi.org/10.1057/s41599-022-01212-6> (accessed 28 February 2024).

¹⁹ See Eurobarometer (2023), Media & News Survey 2023, <https://europa.eu/eurobarometer/surveys/detail/3153> (accessed 28 February 2024).

²⁰ See Kiratly (2023), Social Media Effects on Public Trust in the European Union, Public Opinion Quarterly (Vol 87, Issue 3), Oxford University Press.

²¹ See Raman et al. (2024), Fake news research trends, linkages to generative artificial intelligence and sustainable development goals, ScienceDirect (Vol 10, Issue 3), www.sciencedirect.com/science/article/pii/S2405844024007588 (accessed 28 February 2024).

Under the DSA, providers of VLOPs are subject to new and specific obligations concerning the assessment and mitigation of risks that could result from their services. This includes implementing measures to refine content moderation processes, adjust algorithms, collaborate with trusted entities for flagging misinformation, and introduce awareness-raising initiatives for users. However, the European Commission will play a central role in monitoring and enforcing compliance of providers of VLOPs; akin to its responsibilities in overseeing and enforcing EU competition law. The implementation of the DSA thus presents a significant opportunity to combat misinformation regarding the climate crisis and available solutions in Europe.

What needs to happen

Given the urgency of addressing the climate crisis, the incoming European Commission should make misinformation about the climate crisis and available solutions an implementation priority of the Digital Services Act. Specifically, the European Commission and interested governments should:

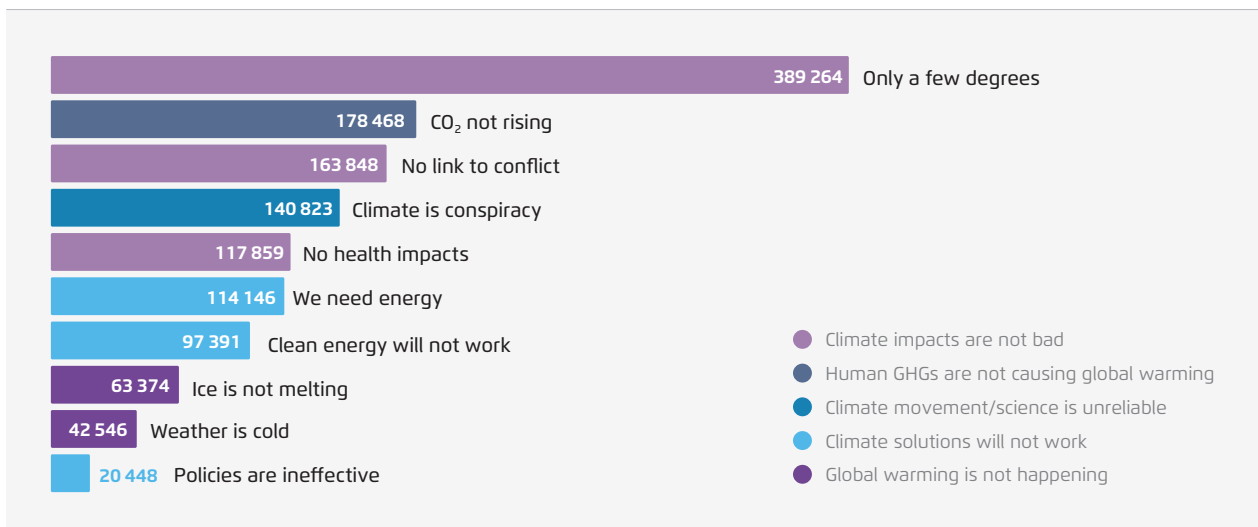
1. **Announce that efforts to combat climate misinformation will be a focus area when auditing the compliance of providers of VLOPs and search engines with the Digital Services Act:** There is ample documentation indicating that climate misinformation erodes the foundation for well-informed democratic decisions regarding climate policies. Effectively addressing the climate crisis stands as a central challenge for both EU and national policymaking. Consequently, the dissemination of climate misinformation on VLOPs qualifies as risk according to Article 34.1 (c) DSA. The European Commission should thus inform providers of VLOPs that it will prioritise efforts to monitor, identify, and address climate misinformation during audits for compliance with the DSA.
2. **Support capacity building for independent monitoring of climate misinformation:** Scientific institutions, think tanks, or civil society groups may express interest in helping to combat misinformation surrounding the climate crisis and available solutions. To fully harness the opportunities presented by the DSA, the Commission and interested governments should actively support these scientific institutions, think tanks, and civil society groups in developing dedicated capacity for monitoring and fact-checking climate misinformation on VLOPs. Capacity building efforts should, at minimum, encompass targeted information and training sessions, the sharing of algorithms and AI-based tools, and could also extend to providing financial assistance for hiring dedicated staff and acquiring suitable IT equipment and tools.
3. **Facilitate the development of algorithms and AI tools designed to identify and counteract attempts to disseminate climate misinformation:** AI tools are currently being employed to generate and propagate climate misinformation. However, they can also serve to detect and mitigate the harm caused by such misinformation. Several governments have already implemented specialised algorithms and AI tools to monitor and curb the dissemination of fake news, particularly concerning matters of national security. Against this background, the European Commission and/or interested governments should provide support for the development of algorithms and AI tools aimed at identifying attempts to disseminate climate misinformation. These algorithms and tools should be made available to scientific institutions, think tanks, or civil society groups interested in engaging in the monitoring and fact-checking of climate misinformation.
4. **Cooperate with the Digital Services Coordinators of Member States to designate “trusted flaggers” for identifying climate misinformation:** To ensure prompt and dependable removal of problematic content by providers of online platforms, Article 22 DSA foresees the designation of so-called trusted flaggers. Online platform providers are mandated to ensure that notifications submitted by these trusted flaggers, operating within their designated area of expertise, are processed and addressed without undue delay. The status of “trusted flagger” is conferred by the Digital Services Coordinator of the Member

State where the applicant is based. The European Commission should collaborate with the Digital Services Coordinators to promptly designate qualified trusted flaggers to combat climate misinformation.

5. Support analyses on how providers of VLOPs could effectively address climate misinformation: Identifying and containing the harm caused by climate misinformation represents a novel area of engagement for providers of VLOPs. Implementing the general obligations outlined in the DSA, specifically regarding climate misinformation, will inevitably give rise to numerous questions. These include how to distinguish between outright “misinformation” and subjective value judgements and determining suitable measures to mitigate damage to democratic discourse caused by misinformation. In this context, the European Commission should spearhead an independent analysis that, bolstered by expert dialogue, comprehensively maps the technical and legal challenges faced by providers of online platforms in identifying climate misinformation. Additionally, this analysis should explore practical measures and their efficacy in mitigating climate misinformation.

6. Develop a best-practice manual outlining strategies for effectively addressing climate misinformation: The independent analysis developed under action point 5 above should serve as a reference point in the Commission's monitoring of DSA compliance among providers of VLOPs, particularly concerning climate misinformation. Insights garnered from this analysis, as well as findings from the Commission's compliance monitoring, should be integrated into the reporting on best practices of VLOPs as stipulated in Article 35.2 of the DSA. This approach will solidify the due diligence obligations of providers of VLOPs under the DSA, specifically regarding climate disinformation.

Number of tweets related to climate mis- and disinformation in December 2022 → Fig. 4



Boston University Institute for Global Sustainability (2023): *How Climate Disinformation Spreads: Twitter*, Boston University Climate Disinformation Initiative.



Greening Europe's industrial base while strengthening competitiveness and resilience in strategic clean technology

Europe faces pivotal challenges in sustaining and fortifying its industrial base amid the transition to climate neutrality. While China's manufacturing dominance poses a competitive threat, it also offers opportunities for affordable investments and accelerated decarbonisation. A strategic approach involves attracting investments from leading clean technology suppliers, including China, with conditions that foster technology transfer and cooperation. Social conditionality, transparent frameworks and safeguards, such as the Carbon Border Adjustment Mechanism (CBAM), must accompany these collaborations to ensure fair practices. Europe's policies should discern between genuine unfair practices and sector-specific challenges, avoiding punitive measures that hinder early adopters or correct inherent competitiveness issues. Navigating this delicate balance is essential for fostering global cooperation in sustainable development while safeguarding Europe's industrial strength. The following policy initiatives would help strike an appropriate balance.

Initiative 5: Prioritise direct electrification of industrial heat to enhance resilience and advance decarbonisation

Why this is important

Among various decarbonisation pathways, the direct electrification of industrial heat entails three strategic advantages for the EU. Firstly, energy security. By 2035, up to 1 860 terawatt hours (TWh) of industrial fuel consumption – to a large extent imported natural gas – could be avoided via electrification technologies²² that are supported by homegrown power generation. Secondly, economic opportunity. Developing large-scale domestic manufacturing and engineering capacity in industrial direct electrification technologies could bolster Europe's position in sectors neglected by competing initiatives such as the US Inflation Reduction Act. Thirdly, supply chain resilience. The availability of affordable clean power is an essential condition for the domestic processing and recycling of critical raw materials (CRMs) – a crucial choke point in the raw materials value chain and a core component of the EU's Critical Raw Materials Act (CRMA).

Of course, direct electrification is not a silver bullet for all industrial heat classes. In addition, while direct electrification is expected to be more efficient and cost-competitive than rival solutions such as hydrogen or biomass in the mid-to-long term, it also presents challenges. These include: delays and costs associated with the expansion of and connection to the distribution grid; the high capex associated with retrofitting and reconfiguring aspects of production lines; relative inexperience and conservatism at firm level, especially for the electrification of higher-temperature industrial heat and on-site power and heat storage technologies; the high cost of electricity relative to gas in several EU Member States; and inverse incentives including the zero rating of biomass emissions in the EU ETS, incentives for waste incineration and gas-fuelled combined heat and power, and grid charges disincentivising demand response.

In the long run, it is likely that some of these problems will be more easily resolved for direct electrification than for alternative solutions. For instance, hydrogen, carbon capture and storage (CCS), and biomass come with less energy efficiency, higher capex, and

²² Agora Industry, Fraunhofer Institute for Systems and Innovation Research ISI (2024, forthcoming).

higher prospective scarcity (and thus higher costs) in a decarbonised economy. Direct electrification should therefore be seen as a core pillar of the EU’s long-term strategy to decarbonise industrial heat, even if it is part of a more eclectic mix of solutions in the short term.

What needs to happen

There are numerous barriers to electrification and no single solution to address them. Thus, a coordinated strategic approach is required.

An EU Industrial Electrification Action Plan is needed including a package of different measures to address them. Potential components for the plan could entail:

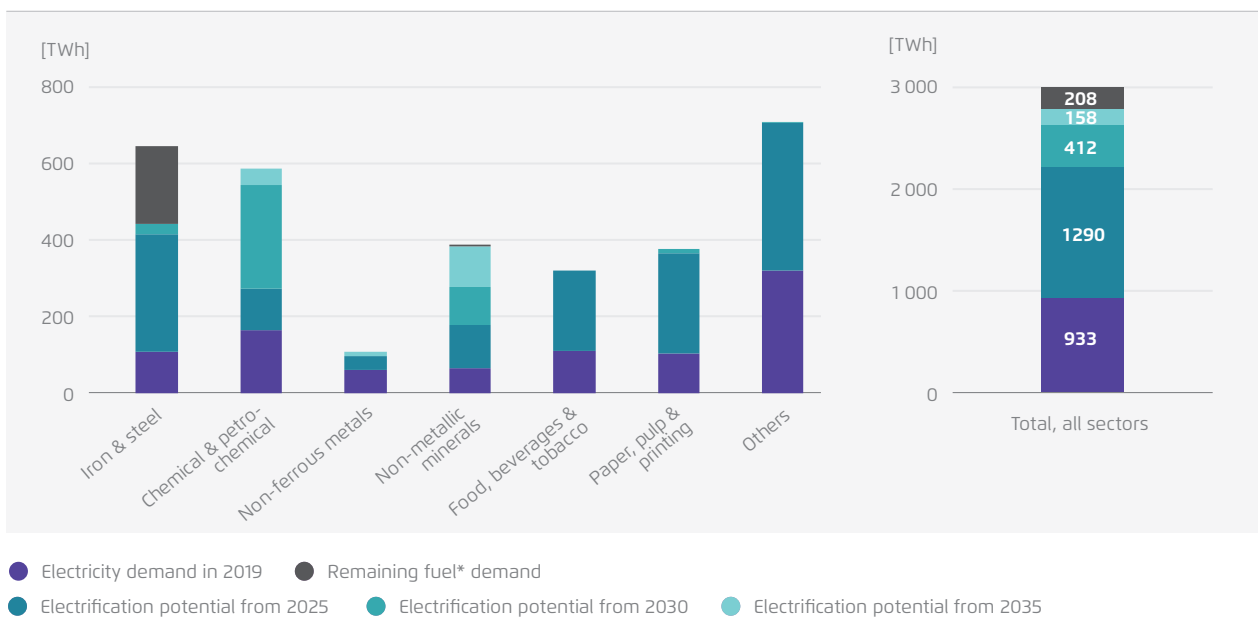
1. **Establish an Industrial Direct Electrification Technologies Alliance:** Based on the model of the Battery or Hydrogen Alliances, this platform should facilitate demand-supply matching to

kick-start a pipeline of projects and the technology and skills value chains. A promising starting point could involve leveraging the EU’s Heat Pump Accelerator, which could also include *industrial* heat pumps as a core focus of its work.

2. **Set deployment and phase-out targets:** Demand visibility is an essential condition for investment. Accordingly, the EU should set heat pump and e-boiler deployment targets for 2027, 2030, and 2035 to advance this objective, as well as phase-out dates for the use of fossil gas in low- and medium-temperature heat applications.
3. **Incorporate industrial direct electrification technologies into EU cleantech funding:** The high capex associated with installing and retrofitting direct electrification solutions is a key barrier to the uptake of these technologies. Direct-electrification technology could be mainstreamed as a funding priority under different existing funds, including the EU ETS Innovation Fund and Horizon Europe.

Technical potentials for direct electrification by industrial sector (left) and total (right) in the EU-27

→ Fig. 5



Agora Industry, Fraunhofer Institute for Systems and Innovation Research ISI (2024, forthcoming): *Direct electrification of industrial process heat*. Note: Based on 2019 Eurostat data. The estimated direct electrification potential is relative to the 2019 fuel-based energy demand and based on technologies expected to be available by 2025, 2030 and 2035 respectively. *Fuel covers fossil fuels, biomass and district heating. The avoided fuel demand is to be differentiated from the resulting electricity demand.

4. **Integrate industrial electrification in grid expansion planning:** The EU should adopt governance provisions requiring national grid operators to take into account industrial electrification when performing adequacy assessments and grid planning; establish a maximum time-frame to connect industrials seeking a distribution network expansion or contract a third party to provide the connection if the deadline cannot be met; and subsidise the minimum share of cost of connection to the grid under certain conditions. Efforts should also prioritise processing pre-feasibility studies and permitting requests concurrently, rather than sequentially.
5. **Clarify EU State aid rules on industrial power prices for strategic sectors:** The EU should provide guidance on State aid to Member States regarding the adoption of industrial clean power prices or other tax advantages related to

electricity consumption, contingent upon their contribution to EU strategic industrial priorities. Criteria could include new investments into domestic manufacturing of net-zero strategic technologies or critical materials processing, and investments that replace fossil fuels with high quality clean power purchasing agreements (PPAs).²³ Crucially, incentives for demand response and energy efficiency should be retained in the design of the mechanism.

6. **Require Member States to develop dedicated net-zero industrial heat strategies:** These strategies should include related infrastructure and resource constraints in their analysis and feed into the Member State National Energy and Climate Plans for the period 2030-2040.

²³ A "high-quality clean power PPA" would need to be defined. Currently, beyond the Delegated Act on Clean Hydrogen, no such definition exists in EU legislation.

Initiative 6: Leverage the single market to drive cleantech manufacturing investments in Europe and diversify global value chains for crucial green materials

Why this is important

The war in Ukraine and the resulting energy cost crisis highlighted the dangers for Europe's economy of over-reliance on individual countries for certain strategic economic inputs. Enhancing resilience in a more contested geopolitical context while advancing the energy transition requires a green industrial policy. However, Europe's ability to execute an effective industrial policy – compared to the EU's main global competitors – is increasingly called into question, particularly since the launch of the Inflation Reduction Act in the United States.

These imbalances also pertain to fundamental issues that the existing multilateral trade system seems unable to address. A case in point is China, whose economy operates under a mixed economic model for which the WTO's rules were not designed. China's scale makes these problems structural and systemic, as evidenced by subsequent US moves undermining

the WTO. Moreover, rising geopolitical tension and the multiplication of conflict flashpoints suggest that the ongoing shifts in the existing global order go beyond adherence to WTO rules. This suggests that the EU might have to make fundamental decisions regarding investments in its security, including within its defence and strategic value chains. This will affect the political and spending priorities for the next five years.

The EU's response to these issues – notably via the Net-Zero Industry and Critical Raw Materials Acts (NZIA and CRMA) – is a start of sorts, but both lack substantial incentives capable of catalysing change in investment behaviour and closing Europe's resilience gap. A key challenge is the EU's cost and capital market depth disadvantages compared to key competitors. This is compounded by political hurdles in unlocking equivalent amounts of subsidies or mechanisms to enhance the effectiveness of venture capital markets. Moreover, the EU has so far been

very reluctant to utilise trade instruments, such as quotas, on competitors on whom it over-relies, due to concerns about potential retaliation. Similarly, the EU is nervous about competitors' local content requirements affecting downstream costs for industrials or consumers. However, instead of leveraging the EU's weight to settle these issues – either through cooperation, confrontation, or via a balance of both, large EU Member States are acting in a way that undermines trust and burns diplomatic bridges. If the EU remains opposed to implementing the most effective policy options, the NZIA and CRMA will have limited effect.

However, strengthening Europe's industrial resilience and competitiveness entails more than simply reshoring activities to the EU. It also necessitates diversifying suppliers. Moreover, if the Green Deal is to impact the climate, the EU also needs to try to export the greening of industrial value chains beyond its borders. The Union should not necessarily seek to use environmental trade policy as a disguised trade barrier, but rather as a way of promoting investment in green production abroad, in a way that complements European industrial priorities.

What needs to happen

When calibrating its strategy, the EU needs to be mindful of fundamental trade-offs, such as between keeping the costs of the transition low and addressing the initially high costs of supporting the repatriation of production; between the short-term need to insulate production from competition and the long-term need to maintain robust competition; between restricting trade in certain sections of the value chain and expanding new geopolitical and economic alliances; and between protecting legitimate security interests and avoiding alienating third countries.

While the necessary balance will largely depend on the broader context, the EU can enhance its ability to steer towards a mutually beneficial outcome for itself and its partners by following these general orientations and actions:

1. **Develop the missing economic incentives to achieve the domestic production targets of the Net-Zero Industry and Critical Raw Materials Acts:** Incentives should include: offering below-market interest loans to investors in strategic value chains; developing more liquid and deep (venture) capital markets; developing demand visibility for specific technologies; enabling access to affordable industrial electricity prices to reshore critical raw materials processing; where overdependence exists today, negotiating the re-localisation of foreign production from China back to Europe, or to third countries; and establishing and gradually phasing-in import quotas on CRM or NZIA products or components so that no more than 50 percent can originate from a single country.
2. **Attempt to constructively renegotiate trading and investment relationships with China and the US in specific value chains where legitimate sensitivities exist:** Before resorting to trade sanctions, costly subsidies, or trade barriers, the EU should seek to reach mutually acceptable renegotiations of the terms of trading relationships with both the US and China. The EU should clearly express its intention to remain a close trading partner with both nations, but emphasise that a more balanced trading and security relationship is needed, both in general and in certain value chains in particular. The EU should clarify several conditions, including reciprocal market access, the avoidance of overdependence on strategic goods, and the environmental and social sustainability of supply chains.
3. **Develop strategic clean industry partnerships:** The EU should promote technology transfer via foreign direct investment (FDI) in clean technology and CRM production in strategic partner countries (on the condition of priority trade access). Additionally, the EU should offer below-market interest loans (and/or loan guarantees) to investors in CRM or strategic technology components produced through climate-friendly processes abroad, in exchange for prioritised access to the resulting output. The Union should also renegotiate voluntary export limits with certain trade partners (or alternatively, set declining

quotas to restrict total imports from specific nations). This strategy aims to incentivise the diversification of production and import locations. Furthermore, the EU should provide greater clarity regarding the demand for clean materials for foreign investors looking to export, including by leveraging its domestic companies to facilitate

bilateral deals. This could be achieved by developing stronger and bigger domestic lead markets for clean manufactured goods and by extending domestic support mechanisms for clean industrial products to imports from strategic partner nations.

Main cleantech value chain risks from an EU perspective

→ Fig. 6

Solar PV	Wind (on-/offshore)	Electrolysers	Heat pumps	Batteries
Market dominance of China along the entire supply chain, low starting point in EU	Profitability of the sector	Market uncertainty	Installation bottlenecks	Sourcing of raw and processed input materials
Limited production of pre-components	Single supplier dependence on critical raw materials and components (permanent magnets)	Production competitiveness in the established alkaline sector	Market and demand uncertainty given volatile regulatory environment	Market dominance of Asian industry leaders
Profitability and competitiveness of production	Increasing competition from China	Reliance on critical raw materials with limited sources	Low economies of scale compared to competitors	

Agora Energiewende and Agora Industry (2023): Ensuring resilience in Europe’s Energy Transition: The role of EU clean-tech manufacturing.

Initiative 7: Scale up lead markets for climate-friendly materials and technologies

Why this is important

Investments in strategic decarbonisation technologies are facing considerable barriers. Firstly, upfront costs often exceed those for conventional technologies. Secondly, new products may face consumer resistance due to lack of familiarity and conservatism. Thirdly, the fiscal capacity of governments to derisk early investment through state subsidies is limited and will only go so far in creating a robust business case for investing in capital-intensive new production technologies. Similarly, carbon pricing instruments need complementary policies to succeed.

A viable business case for these technologies – not just for a pilot plant, but to shift entire investment strategies of companies – requires the presence of consumers willing (or required by legislation) to

pay more. Establishing lead markets through policy measures can effectively mitigate initial barriers to broader markets creation. From a strategic standpoint, accelerating and scaling up markets for clean manufacturing does not only benefit domestic European producers. It can also promote green manufacturing abroad, helping to turn the Green Deal into an industrial opportunity for the region and beyond.

The European Green Deal has made some tentative steps to establish lead markets for basic materials. For instance, the Construction Products Regulation (CPR) and the Ecodesign Regulation propose to create performance labels for CO₂ emissions and digital product passports for some construction products and a number of other products yet to be determined. The CPR also offers Member States the possibility to adopt green public procurement requirements,

although the extent and magnitude of these obligations remains highly uncertain. The Energy Performance in Buildings Directive (EPBD) also mandates Member States to establish life cycle carbon limits on new buildings exceeding 1 000 square metres by 2028. However, the specific level of ambition and compliance methodology remain equally uncertain. For cleantech manufacturing, the Net-Zero Industry Act will spur some demand. However, it remains to be seen whether the scale and timing of that demand would warrant investments in additional domestic production capacity that need to happen in the coming decade. Overall, these efforts are relatively preliminary and may take a considerable amount of time to materialise, let alone reach the scale required to underpin sector-wide transitions.

What needs to happen

All in all, speed and scale are the primary concern. The European Green Deal has implemented several regulatory constraints. However, it still lacks the necessary conditions to facilitate investments. The fast creation of scalable (lead) markets for clean products and technologies is one of these conditions. To develop effective lead markets, the EU should:

1. **Ensure the effective implementation of embodied carbon requirements for new buildings:** Several Member states will need support to rapidly develop capacity to implement robust schemes with real ambition. Firstly, lessons should be learned from successful, existing national schemes (e.g. in France, the Netherlands, and Nordic countries). Secondly, a harmonised methodological framework to measure embodied carbon across the internal construction market must be developed at EU level. Thirdly, national embodied carbon threshold values must be ambitious and decrease rapidly during the 2030s.
2. **Develop robust embodied carbon reporting standards for material-intensive non-building products:** These products include new vehicles, infrastructure, packaging, heavy equipment, and machinery. Initiatives to develop embodied carbon reporting for these products should

continue under the Ecodesign Regulation and the Digital Product Passport. To enhance speed and effectiveness, these initiatives should focus on the most material-intensive products and on the most CO₂-intensive components of products. Additionally, they should establish a robust reporting methodology that is product-specific and rectifies inaccuracies in existing ISO (International Organisation for Standardisation) and EN (Euronorm) standards for life-cycle assessment reporting.

3. **Introduce requirements to continuously increase the share of near-zero emissions materials in sales of new vehicles and other large equipment in the EU:** Requirements should build on existing pledges and corporate strategies by leading companies. Quotas should be applied at the internal market level and encourage the optimal CO₂ performance for materials such as steel, aluminium, plastic, and concrete to provide high demand visibility to investors in deep decarbonisation technologies.
4. **Require governments to set ambitious and effective green public procurement criteria for basic materials in construction:** The EU should revise the Public Procurement Directive to establish requirements for Member States to implement near-zero emissions quotas for steel and concrete in all tenders exceeding a certain threshold. The public procurement quotas should be increased over time to match the timeline for decarbonising the steel and concrete production according to the EU timeline for the ETS and the Carbon Border Adjustment Mechanism (CBAM).
5. **Establish private buyers alliances among European companies to amplify the demand for green basic materials and intermediate products:** While essential, public procurement and other regulatory measures will take time to be fully implemented. Meanwhile, the EU should use its convening power to encourage pledges for purchasing clean industrial materials from the private sector in Europe. This will help generate strong demand signals for banks to provide loans to investors for climate-neutral manufacturing sites. The recycled plastics purchase pledging system serves as a commendable model in this

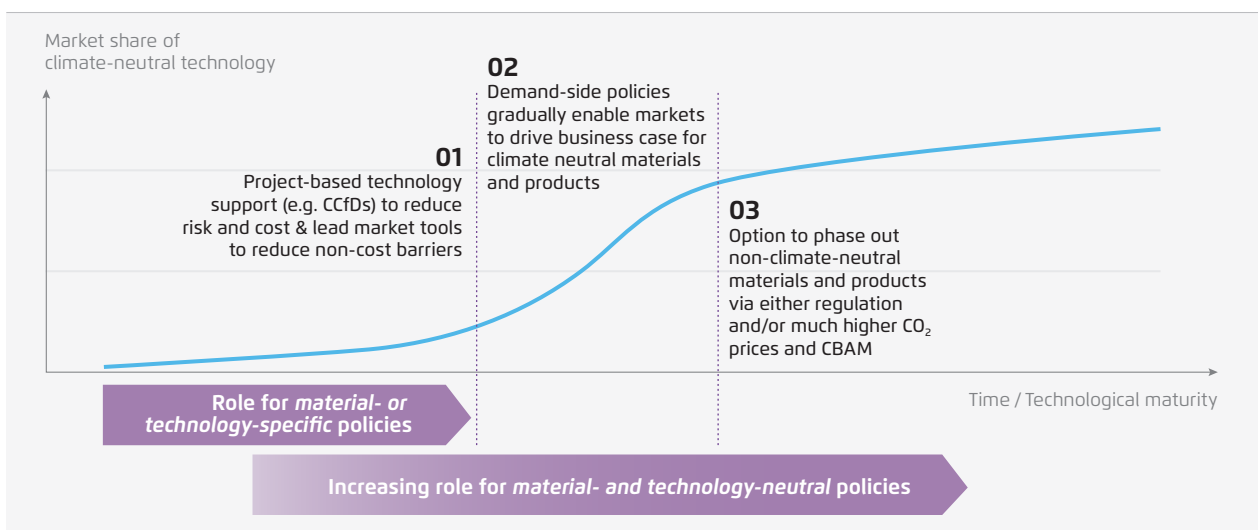
regard. Such an alliance could also help pool demand by strategic partners abroad for both local and foreign production.

6. **Engage with the OECD Climate Club to create green buyers alliance of nations:** The EU should cooperate with its partners in the Organisation for Economic Co-operation and Development (OECD) to establish a combination of green market commitments, transatlantic CO₂ product requirements for steel and aluminium, and common reporting and labelling frameworks in order to advance global lead markets for clean basic materials and industrial components. These tools should encompass all ambitious nations, regardless of origin, and underpin OECD and G7 efforts to establish an industrial climate alliance or “club” focusing on basic materials.
7. **Sign trade and investment facilitation agreements within specific value chains to promote strategic industry partnerships for clean products and materials:** The CBAM and Ecodesign Regulations are expected to encourage the decarbonisation of manufacturing abroad. However, further measures could be considered. The EU should explore the possibility to establish FDI and trade facilitation deals with certain strategic partners. These agreements would promote free

trade in clean basic materials and intermediate products, critical raw materials, clean energy, inputs (e.g. Power-to-X (PtX) products, ammonia, and biobased basic chemicals), as well as components of strategic net-zero technologies. Facilitation deals would reduce trade tariffs and promote new and greener supply chain connections between the EU and strategic partners. The deals should comprise a tailored package of measures, including the tariff reduction, the establishment of platforms to match European buyers of clean materials with competitive suppliers, and the implementation of co-financing instruments to de-risk investments abroad. These measures would complement the EU’s demand-pull policies outlined above, ensuring that lead market policies support both value chain diversification and supply-side diversification initiatives in strategic partner nations (see Initiative 6).

The possible role of material-specific vs. material-neutral policy drivers at different stages of the transition to climate neutrality

→ Fig. 7



University of Cambridge Institute for Sustainability Leadership (CISL) and Agora Energiewende (2021): *Tomorrow's markets today: Scaling up demand for climate neutral basic materials and products.*

Initiative 8: Integrate circular economy incentives and technology funding in EU industrial policy

Why this is important

The EU has made significant strides in promoting a circular economy over its past two mandates. For instance, the Batteries Regulation establishes material-specific targets for recycling efficiency and mandates recycled content targets for all critical raw materials in the battery value chain. The End-of-Life Vehicles (ELV) Directive, currently under discussion, lays the groundwork for setting minimum recycled content requirements for steel in cars and CRM in motors of electric vehicles. Similarly, the CRMA imposes standards on the recyclability and the recycled content of permanent magnets.

However, the scope of the circular economy agenda still primarily revolves around waste management, leaving critical gaps in other areas. More attention is needed in areas where circularity shows a high emission reduction potential such as construction materials, steel and aluminium, critical raw materials, other metals, and plastics.

While the circular economy is frequently referenced in climate statements, it also seldom takes precedence in climate policy making, which typically concentrates on decarbonising the production of primary materials. However, integrating circular economy considerations into the EU's industrial policy offers numerous opportunities. Firstly, it would foster technological advancement and manufacturing opportunities in material-efficient collection, sorting, recycling, and materials processing technologies, as well as in logistics and digital tracing technologies. Notably, while certain forms of recycling are attracting investment abroad, the EU has the technological capacity to lead across a much broader range of value chains than its US or Asian competitors. Secondly, mainstreaming the circular economy would strengthen the resilience of strategic value chains by reducing the EU's reliance on imported virgin CRM. Thirdly, this would offer an outlet for large amounts of end-of-life materials, especially in construction

and the automotive sector. Recycling these materials promises to deliver significant competitive advantages for the EU's industry in terms of reshoring key segments of the supply chain associated with recycling and re-use. Finally, recycling would facilitate the decarbonisation of the basic materials industry by reducing the demand for energy required in primary production.

What needs to happen

1. **Introduce minimum recycling performance standards and design-for-circularity requirements:** The EU should establish minimum performance standards for installed recycling processes in key value chains, such as mandating post-sorting of mixed waste to recover up to 70 percent of plastics lost from the recycling chain. Design-for-circularity requirements including upgradeability, remanufacturing, and re-use should also be established or enhanced for key technologies.
2. **Introduce safeguards for waste incineration:** The EU's ETS revision includes plans to expand its scope to cover waste incineration. However, relying solely on carbon pricing could increase the risk of diverting waste to landfills or exporting it abroad. Safeguards should include stricter regulations against illegal dumping, restrictions on the export of waste, and better monitoring and data collection on incinerator emissions.
3. **Earmark EU climate funds:** Innovation and the deployment of cutting-edge circularity technology should be mainstreamed into EU climate funds. Particularly, the EU ETS Innovation Fund should include a dedicated funding window for circular technology.
4. **Establish minimum recycled content requirements for key technologies:** The EU should intensify efforts to expand markets for recycled basic materials in order to stimulate investment in the upstream value chain. Minimum recycled

content requirements – similar to those foreseen in the Batteries Regulation – could serve this objective. The range of application should include products containing large amounts of CRM or CO₂-intensive basic materials, e.g. cars, e-drive motors, building components, machinery, equipment, as well as strategic technology like solar PV.

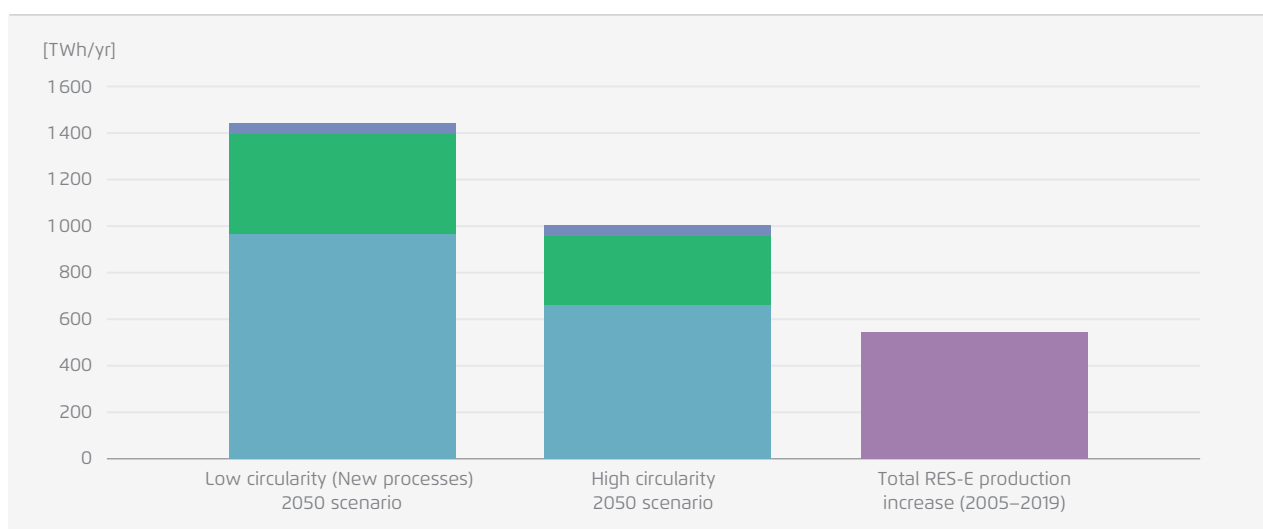
5. **Introduce a minimum materials contribution:** Member States should be required to levy a minimum materials charge, the proceeds of which would be earmarked for industrial transformation efforts. Even a modest, broadly-based contribution could generate substantial funds at the EU level. A portion of these funds should be allocated to support the deployment of state-of-the-art processing capacity for CRM and other cutting-edge recycling technologies for basic materials.
6. **Consider stricter export limitations for secondary materials:** To prevent the outflow of valuable resource materials, the EU should explore export limitations for intermediate waste streams (such as black mass), as well as for strategic technologies like used lithium-ion batteries and solar

PV. This could be modelled after the proposed ELV directive, empowering the Commission to mandate a minimum share of recycled steel to be used in vehicles.

7. **Finalise the legal framework for battery recycling:** The next Commission should ensure the environmental integrity of the remaining delegated acts of the EU Batteries Regulation. After the finalisation of the Critical Raw Materials Act, the Commission should also develop appropriate monitoring instruments for its implementation.

Additional power needs for the decarbonisation of steel, cement and chemicals, low- vs high-circularity scenarios. Total increase in electricity production from renewable energy sources (RES), 2005–2019 in the EU

→ Fig. 8



● Direct electrification ● Indirect electrification (H₂) ● Electricity for CCS ● Total electricity production increase from RES in 2005–2019

Agora Industry (2022): *Mobilising the circular economy for energy-intensive materials. How Europe can accelerate its transition to fossil-free, energy-efficient and independent industrial production.*



Scaling clean power and net-zero infrastructure

Renewable electricity generated by solar PV and onshore and offshore wind will be at the heart of Europe's climate-neutral power system, with renewable electricity reaching a share of around 70 percent of the power mix by 2030 and 80–95 percent in a climate neutral power system, depending on the scenario. This means a tripling in the speed of yearly installed new renewable power capacity from today to 2035, compared to the 2010–2020 decade. Security of power supply is achieved – depending on geography – through a smart mix of short-, medium-, and long-term storage technologies combined with back-up generating capacity fired by climate-neutral fuels, such as renewable hydrogen; and according to some national plans also nuclear electricity. Renewables are also a main lever to strengthen Europe's energy security and to compete in the global race for clean technology leadership.

The Fit for 55 package provides clarity on the EU's goal and deployment pathway for renewables until 2030. However, delivering on this ambition will be challenging. EU countries currently do not plan for a sufficient increase in the share of renewable energy by 2030 and a range of risks could result in delays or cost overruns of renewable power projects. Furthermore, renewable power projects will compete with fossil energy sources for years to come. As long as EU countries have not yet devised robust strategies for phasing down fossil energy use or for replacing fossil with non-fossil energy carriers, purely market-based investments into renewable projects remain difficult. In addition, most of Europe currently lacks long-term infrastructure development plans that are based on robust net-zero scenarios. The following policy initiatives would address these challenges.

Initiative 9: Use all means to derisk and accelerate renewables investments

Why this is important

Renewable energy sources, especially wind and solar, are set to become the dominant power generation technologies in Europe in the coming years. Their combined share is expected to rise from 44 percent today²⁴ to a projected 72 percent by 2030 and further to 81 to 87 percent by 2040, according to the European Commission's 2040 climate target impact assessment.²⁵ Compared to the decade spanning 2010 to 2030, this means a threefold increase in the rate of annual installation of new renewable power capacity from the present to 2035. Renewables will be key in initially eliminating emissions from the power sector

and subsequently aiding in the reduction of emissions across transport, industry, and buildings. This will be achieved through direct electrification (e.g. via heat pumps and electric vehicles), as well as partially through indirect electrification (e.g. hydrogen and e-fuels).

In addition to low lifecycle GHG emissions of wind and solar power, their central role in climate neutrality scenarios is largely due to the strong cost competitiveness of these two technologies when assessed on a levelized cost basis. Wind and solar installations are more economical to build and to operate throughout their lifespan compared to nuclear power generation and competing fossil fuel-based technologies. As a result, renewables are also no longer solely viewed as a decarbonisation technology. Instead, access to cheap renewables is increasingly regarded as a key

²⁴ Ember (2024).

²⁵ European Commission (2024b). See also https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en

factor for the competitiveness of energy-intensive industries in Europe,²⁶ alongside energy security and the attainment of leadership in clean technologies. By implementing smartly designed two-sided Carbon Contracts for Differences (CCFDs), renewable energy support schemes can even provide fiscal revenues that could then be redistributed to consumers. This approach enables end consumers to experience greater benefits from the low costs of renewable technologies compared to the current scenario.

At the same time, renewable energy projects entail significant capital investment and therefore are particularly vulnerable to risk. Factors such as inflation, rising interest rates, supply chain disruptions, limited land availability, as well as delays in permitting or grid connections, directly translate into higher investment costs and deferred investment decisions. Whilst the price of emissions allowances within the ETS constitutes a key element for the economic viability of RES projects, it is becoming evident that not all projects are bankable without additional guarantees and/or regulatory signals. Moreover, the political outlook suggests that the volatility of (cost) factors may become a permanent characteristic of Europe's 'mid-transition', that is marked by the rapid expansion of renewables and the gradual reduction of fossil fuel-based energy systems.

The EU has adopted several laws and strategies to address these concerns: The revised Renewable Energy Directive, for instance, sets targets for the expansion of renewable energies and minimum criteria for identifying suitable land, streamlining permitting processes, and facilitating grid connection. EU energy market rules oblige regulators and system operators to facilitate the integration of increasing shares of renewable electricity into the power system. The EU Solar Energy Strategy released in May 2022 and the EU Wind Power Action Plan introduced in October 2023 seek to accelerate the deployment of these critical technologies. Finally, the forthcoming EU Net-Zero Industry Act is set to acknowledge solar photovoltaics, as well as onshore and offshore

wind, as strategic net-zero technologies. The recently adopted Critical Raw Materials Act aims to enhance access to raw and refined materials essential for producing renewable energy technologies. It is imperative that Member States swiftly and comprehensively implement these initiatives.

At the same time, uncertainty remains regarding the overall ambition of EU countries concerning renewable energy policies. The currently proposed national contributions to the EU's renewable energy target project a renewable energy share of around 39 percent by 2030. This figure falls significantly short of both the EU-binding target of 42.5 percent by that date, and even more so considering the aspirational target of 45 percent.

What needs to happen

The incoming European Commission should employ all available means to derisk and accelerate renewables investments in Europe. Specifically, it should:

1. **Monitor closely the effective implementation of the new EU Renewable Energy Directive:** Although the EU cannot determine national energy choices, it is obligated to ensure that the EU as a whole progresses towards climate neutrality in alignment with EU targets. It should ensure that the crucial expansion of renewable energy in the power sector adheres to the EU's binding renewable energy target. Specifically, the incoming European Commission must ensure that all EU countries contribute at least their respective minimum share to achieving the EU's renewable energy target, and take all necessary steps to expedite permitting for solar PV and wind energy projects.
2. **Improve access to financing:** The Commission should work with governments, regional authorities, the European Investment Bank, and public banks of EU countries to expedite and expand access to financing under favourable conditions for renewable energy projects. This effort should also facilitate the involvement of local communities and smaller companies.

²⁶ EPICO et al. (2023).

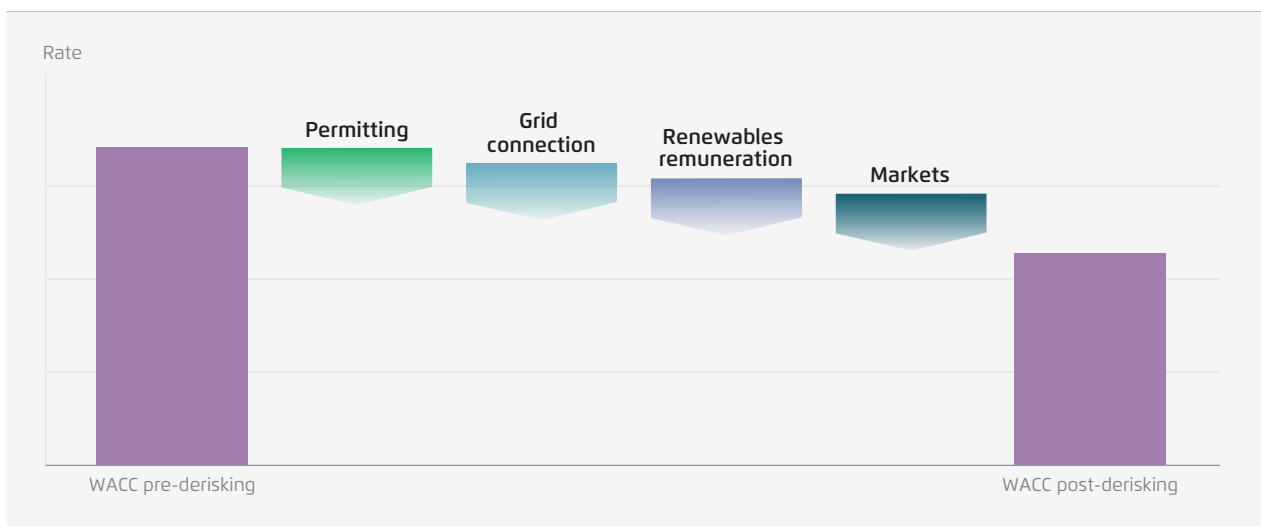
3. **Establish a regular political review of renewables deployment within the Council:** The Commission should collaborate with the respective Council Presidencies to organise ministerial-level exchanges on the renewables build-up at least once per Council Presidency. These exchanges should focus on the status and future prospects of renewable power/energy deployment in the Union (newly deployed capacity, planned capacity, best practices in overcoming barriers to scaling renewables). It should build on close-to-real-time data via satellite monitoring, from financial markets, and professional associations.
4. **Employ the EU Renewable Energy Financing Mechanism:** The EU Renewable Energy Financing Mechanism provides EU Member States with the opportunity to support the deployment of renewables across the EU. Member States can make financial contributions, which are then utilised to fund projects in other Member States willing to host them. However, the mechanism is currently underfinanced. The next European Commission should use its authority under the EU Governance Regulation to mandate

EU countries that fail to meet their targets to contribute to the EU Renewable Energy Financing Mechanism. Additionally, it should explore the possibility of making the one-off solidarity contribution from fossil oil and gas firms, adopted as part of the measures following the Russian invasion of Ukraine, a permanent funding source for the scheme. Lastly, any business should have the opportunity to showcase its green credentials by contributing to the mechanism, offering an alternative to using guarantees of origins or any future EU green power label.

5. **Contingency planning to ensure the collective EU renewables target is achieved:** The Commission should ensure that EU countries planning to rely heavily on nuclear power and CCS to attain a climate-neutral power sector undertake contingency planning. This planning should aim to mitigate risks to security of supply or decarbonisation objectives in case of delays or cost overruns in these projects due to technical difficulties. Each Member State should bear the risk of non-realisation or cost overruns and should not be able to transfer this risk to the EU as a whole.

Addressing perceived higher investment risks for renewable energies in parts of Europe

→ Fig. 9



- Clear and simple permitting rules
- Up-to-date grid connection rules
- Stable renewables remuneration policies, incl. inflation indexation, EU budget guarantees
- Liquid and well-functioning balancing and intra-day markets

Agora Energiewende (2024) based on NewClimate Institute (2019): *De-risking Onshore Wind Investment – Case Study: South East Europe*. Study on behalf of Agora Energiewende. Note: WACC: Weighted Average Cost of Capital

6. Reform the guarantee of origin regime for renewable electricity: The EU should urgently revise its guarantee of origin regime for electricity, introducing a green label that offers more granular information on the extent to which contracted power contributes to new renewables

investments and helps systems to become smarter. Such a scheme would enable consumers and investors to gain a clearer understanding of the environmental impact of their electricity supply and align with the objectives outlined in the recently presented Green Claims Directive.

Initiative 10: Develop an EU framework for net-zero-compatible energy infrastructure

Why this is important

As a society, we need to transition from fossil fuels to cleaner energy sources, from centralised to decentralised production – while making sure our system is secure and affordable for everyone. Our current processes are not optimised for that. The sluggish pace of grid deployment and a growing connections queue threaten the scaling up of RES, while gas networks are expanding despite decarbonisation scenarios urging reductions in our dependence on gas. The current rationale behind hydrogen deployment is to maximise the use of current gas assets, rather than deploying hydrogen where electrification is not an option. However, this approach risks expensive lock-ins and stranded assets and may result in blends of gaseous fuels that several industry branches are ill-equipped to deal with. In addition, progress in developing long-term energy and CO₂ storage at scale has been slow, and the energy sector seems to be trailing behind other sectors, such as transport, in terms of innovation and digitalisation. At the regional and local levels, heat grids need to be developed or expanded, and charging infrastructure, including for heavy duty vehicles, needs to be deployed. However, relevant information based on regional and local planning is not adequately reflected in EU infrastructure planning. As an example, fast charging stations for lorries often require several megawatts of power capacity, but as of today, there is a lack of guidance for transport actors regarding the optimal locations for grid connections. This threatens the attainment of the objectives outlined in the Regulation on Deployment of Alternative Fuels Infrastructure (AFIR).

Grid planning and deployment must no longer be treated as an isolated exercise. Instead, it must be recognised for what it is – a public good and a means to achieve other policy objectives, such as industry competitiveness or the minimisation of methane leakage. The failure to swiftly connect new users and producers directly affects the competitiveness of European industry. This includes the energy-intensive industry that must make investment decisions to decarbonise over the next years in order to be prepared for the next decade when free allowances are phased out under CBAM. If transmission grid operators do not manage to provide the necessary infrastructure in time, new ideas such as organising open tenders for individual energy infrastructure projects should be explored. The inefficiency in using existing assets, equipment, and labour for future infrastructure, along with the failure to prevent stranded assets and costly duplication of infrastructure, also has a price for society as a whole. A recent Agora Energiewende study on the German distribution gas grid estimated that without adjustment of grid management there is a risk of a 16-fold increase of grid tariffs and 10 billion euros of stranded assets.²⁷ The systematic exclusion from EU scrutiny of State aid for grid operators requires reconsideration alongside the practice of prioritising the trading of leaky gases within the internal market over minimising those leaks through localised usage. Finally, climate adaptation needs to be integrated into planning processes to address the risks to reliability and supply posed by floods and droughts, as well as to account for externalities that are not yet factored into investment valuations.

²⁷ Agora Energiewende (2023b).

What is still missing from the EU's Energy System Integration Strategy of 2020 four years later is planning processes for sector coupling and the electrification of transport and heating, rather than viewing power and gas in isolation. The need for enhanced joint planning and regulatory oversight has been recognised in the recently agreed Gas and Hydrogen Package, yet the changes will not go far enough. What is needed is a top-down framework for each energy vector by a regulator with a net-zero mandate, as well as EU-level transmission system operator (TSO) planning that transcends mere aggregation of plans by national operators. This becomes even more important as we are entering a phase of significant fossil gas reduction which will need careful framing. Designing the interplay between heat, electricity, and fuels in a net-zero future is a highly political task. It needs to be based 1) on publicly available data and 2) increased public ownership of investment decisions. These points are also emphasised by Tagliapietra et al. in their call for an independent energy agency.²⁸

What needs to happen

1. **Develop a new net-zero infrastructure strategy and plan:** Revisit the 2020 European energy system integration strategy, accompanied by an assessment of whether current governance structures deliver sector coupling, as well as a net-zero infrastructure plan for the EU for 2050. This 2050 plan would adopt a long-term perspective, in contrast to the current 10-year network development plans (TYNDP). It should integrate the electricity, fossil gas, hydrogen, and CO₂ sectors and provide a basis for framing investment decisions at national and local level. This plan can also provide insights into identifying the so-called "no regret" types of infrastructure, where anticipatory investments are justified regardless of future uncertainties.
2. **Consider developing a new grid planning entity with a net-zero mandate:** Similar to the approach taken in the UK, there should be consideration for establishing an independent public EU entity for transmission planning/modelling obligations, which are currently carried out by associations of national grid operators. Infrastructure planning and investment are essential public responsibilities. The independent entity should receive a net-zero energy infrastructure mandate and provide a binding frame for all transmission investments and plans, including decommissioning and repurposing efforts. The EU should promote best practices and provide technical assistance to ensure that independence, integration, and a net-zero mandate are also upheld in network planning at national and local levels. This commitment should be reflected in the allocation of financial resources for future energy infrastructure programmes where incentives should be revised to encourage efficient use rather than overbuilding.
3. **Better plan and direct infrastructure funding:** Infrastructure funding in the next MFF must be based on actual investment needs, including investment needs at local and regional levels. For example, the majority of the estimated 584 billion euros for power grids in the EU over this decade will occur at distribution system operator (DSO) level. However, EU energy funding with the exception of cohesion funding predominantly targets cross-border projects, overlooking this critical aspect. It also narrows down the policy discourse when at European level only transmission gas grids are being discussed, but alternative options for low temperature heat at local level such as geothermal or district heating are less visible. For the transmission level, a strong earmarking should be put in place to ensure, that the bulk of funding is directed towards connecting power grids rather than gas grids in the future as long as the uncertainties around the latter are not assessed more thoroughly. Improvements are also needed in project appraisal, such as through the systematic use of a carbon shadow price in investment evaluation methodologies as is done by the EIB already. Similarly, funding

²⁸ Tagliapietra, S. et al. (2023), Green transition: create a European energy agency, Green transition: create a European energy agency (bruegel.org) (accessed 21 February 2024).

for transportation should more accurately align with independent studies and net-zero modelling and consider the respective role these scenarios assign to various technical solutions.

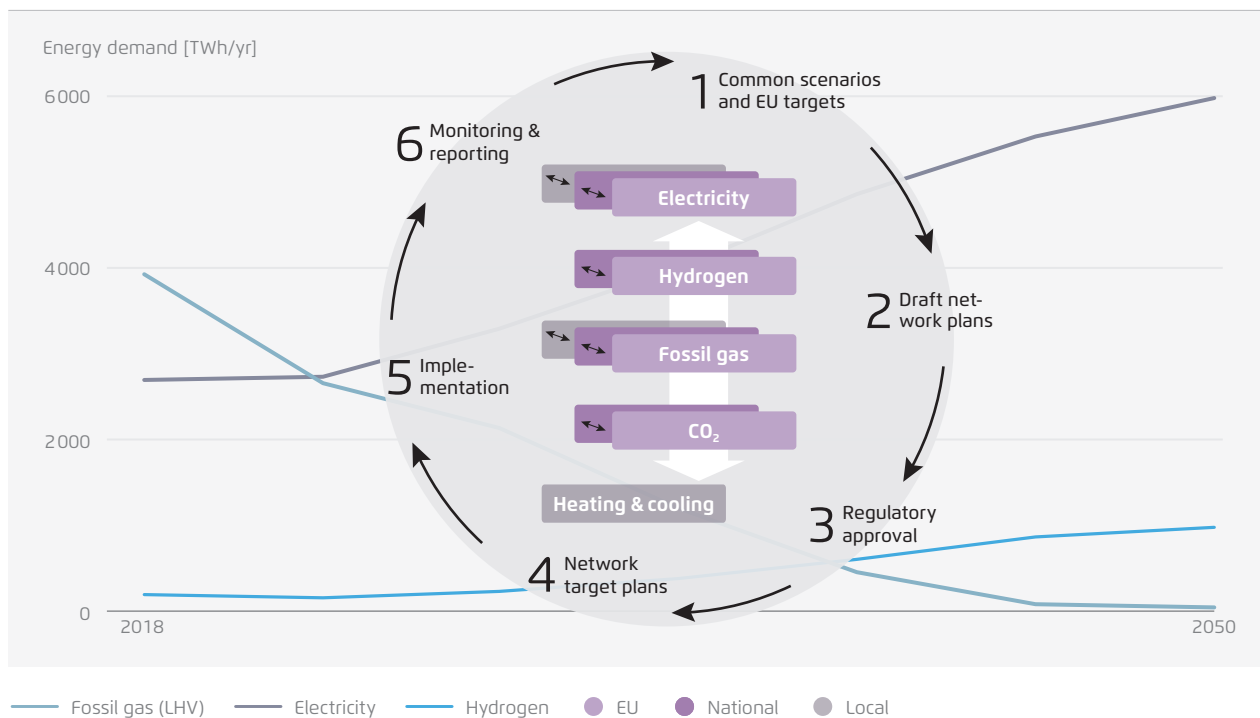
4. **Encourage smarter use of infrastructure:** Finally, there is a need for prices that reflect better the actual physical constraints in the network so that the true value of consumption and production by location and time are rewarded. This would imply additional reforms beyond what was decided in the recent power market reform and e.g. introduce so called locational signals, for example via a bidding zone reform or by introducing nodal pricing. Additionally, the consuming side can be made more reactive when speeding up the roll-out of smart meters, and by increasing demand response based on market prices or congestion signals via dynamic time-of-use grid tariffs or non-firm connection agreements. A recent Agora

Energiewende study estimated how half of the future German household power consumption could be shifted in time allowing households also to benefit financially from such flexibility.²⁹ Such flexible tariffs can generate economic value beyond the power sector itself and allow for new business models, such as those based on system-friendly charging. For gas markets, it remains to be seen how the use of gases including biomethane can be prioritised for sectors that have no alternatives and how measures can be implemented to minimise or at least not ignore leaking during grid passage, beyond what was decided under the Gas and Hydrogen Package. Finally, if operational support (e.g. under carbon contracts for difference, CCfDs) prioritises green

29 <https://www.agora-energiewende.de/aktuelles/wie-e-autos-und-co-die-stromkosten-fuer-alle-senken-koennen>.

EU integrated net-zero infrastructure planning cycle for transitioning to climate neutrality

→ Fig. 10



Agora Energiewende (2024) based on Agora Energiewende (2023): *Breaking free from fossil gas. A new path to a climate-neutral Europe*. Note: LHV stands for lower heating value. Assumptions: Hydrogen and CO₂ network connections may be needed on a local level, however the planning can likely be covered by the national plans. Carbon capture and storage (CCS) is projected to reach 106 Mt of carbon stored by 2050 (waste incineration excluded).

products and services over fossil-based ones, this priority must be reflected in infrastructure plans as well. Similarly for new obligations such

as solar roofs, there might need to be a priority until grid bottleneck issues are solved for those connections that respond to legal obligations.



Scaling climate investments while preserving the sustainability of public debt and a functioning single market

To meet the European Union's 2030 climate target, investments into clean energy, energy efficiency, and net-zero compatible infrastructure need to accelerate across Europe. The bulk of investments will come from private sources. However, public funding plays an important role in de-risking, incentivising or complementing private investments. We estimate that Member States must cover a public green spending gap in the range of 1–2 percent GDP per year to meet the RePowerEU and EU climate ambitions in 2022–2027.

EU-level funding is essential to complement public funding from national budgets, especially for lower-income and fiscally constrained EU countries. During the 2021–2027 budgetary period, the EU's Multiannual Financial Framework (MFF), the Recovery and Resilience Facility (RRF), and funds financed through the EU Emissions Trading System (Innovation Fund, Modernisation Fund, and Social Climate Fund) make billions of euros available for climate investment.

Discussions on a new EU budget for 2028–2034 will start early in the new mandate and take place in a challenging setting: national climate investment needs remain high, financial support from the 750 billion euro RRF ends in 2026, the next EU budget will need to include some repayment of EU debt generated during the crisis, several EU countries have acquired levels of debt beyond the limits foreseen under the EU fiscal pact, while increased defence spending is widely seen as an urgent priority with Russia's war against Ukraine going into its third year. EU climate funding at the scale required can only be imagined if EU funds across all budget lines are more closely aligned with climate investment needs and potentially strengthened by the addition of some new dedicated fiscal revenues. At the same time, EU countries need to anticipate gradually declining revenues from taxing fossil fuels as the EU advances towards climate neutrality.

A more constrained EU budget for 2028–2034 will also increase concerns about the balance between EU and national level spending and tensions in the EU Single Market. If necessary investments into clean energy infrastructure or support to the EU manufacturing of clean technologies rely almost entirely on the availability of national funding, then wealthier Member States will be able to support such investments, while others may not. Effects of national climate subsidies on the Single Market are mostly discussed in the context of EU State Aid rules and will see a difficult balancing act between climate objectives and objectives of undistorted markets and competition*.

* This dynamic was already witnessed under the temporary crisis framework for COVID-19, where of the total €672bn subsidies, more than 53% of approved state aid was for Germany (9% of its annual GDP), followed by 24% for France (6% of its GDP), and 7% for Italy (3% of its GDP).

Initiative 11: Enhance EU climate spending while keeping a sound financial base

Why this is important

As the EU is conducting a mid-term review of the current 2021–2027 EU budget cycle, the next legislative mandate of the European Commission will require an agreement on the subsequent EU budget, spanning from 2028 to 2034. To reach this milestone, a new budget proposal from the European Commission is expected as early as 2025.

According to the Commission's latest strategic foresight report, it is estimated that meeting the objectives of the Green Deal and the REPowerEU plan will require additional investments of approximately 620 billion euros annually in the EU. The public sector will play a crucial role in facilitating this investment, as it will be responsible for constructing public infrastructure, renovating public buildings, and assisting citizens and businesses in financing the adoption of green technologies and practices. For example, financing an accelerated transition in the agriculture, land use, and food production sectors will require extensive new financial resources allocated in the EU budget, extending beyond the capabilities of the current Common Agricultural Policy (CAP).

Partly financing this public spending at EU level can be justified by the shared benefits of the green transition. This approach not only helps alleviate the fiscal burden on Member States in need, but also unlocks efficiency gains through coordination and economies of scale. To achieve this, Member States will need to allocate a portion of their tax revenues to finance dedicated EU instruments (e.g. auctioning revenues from emissions trading).

The EU budget and revenues generated by EU policy instruments, such as emissions trading, also play an important role in fostering solidarity in the transition to climate neutrality. They provide support for low-income households, facilitate just transitions in carbon-intensive industries, and enable intra-EU financial transfers to low-income and fiscally constrained Member States. Central and Eastern

European countries have thus far been significant beneficiaries of instruments like the Modernisation Fund and the Recovery and Resilience Facility (RRF), which have played a crucial role in safeguarding political support for EU climate policies.

Looking ahead, the role of EU funding in supporting increased spending on the transition appears more uncertain. Finding consensus on a new, larger EU budget in the next legislative period is likely to be difficult in the current political and fiscal climate. Many of the resources in the EU budget and other financial instruments, such as the Innovation Fund, have already been allocated or committed beyond capacity and cannot be accessed without deprioritising spending elsewhere. At the same time, around 40 percent of EU grants for climate investment have thus far been funded through the RRF, which is set to expire in 2026. Consequently, EU public climate spending is anticipated to decrease substantially as of 2027, as the Social Climate fund will only partially bridge this funding gap.

In this context, a fundamental EU budget reform is imperative, necessitating a realignment of priorities and more precise targeting of spending. Not only does the current size of the EU budget fail to adequately reflect the investment needs for climate action, but its structure also requires re-evaluation. The EU is investing in decarbonisation through programmes that, in most cases, were originally designed to achieve other policy goals. For example, despite the CAP constituting a significant share of the EU budget and despite a significant portion of the CAP being officially designated as climate expenditure, its impact on reducing emissions in agriculture has thus far been limited.

At the same time, ensuring the sustainability and political acceptability of the EU budget will require that any further increase in spending or borrowing be accompanied by a viable financing strategy. Thus, securing additional sources of EU revenues will be essential to fund increased climate-related

expenditures. Additionally, enhancing the efficiency and effectiveness of EU spending is needed to render higher EU co-financing more acceptable to Member States.

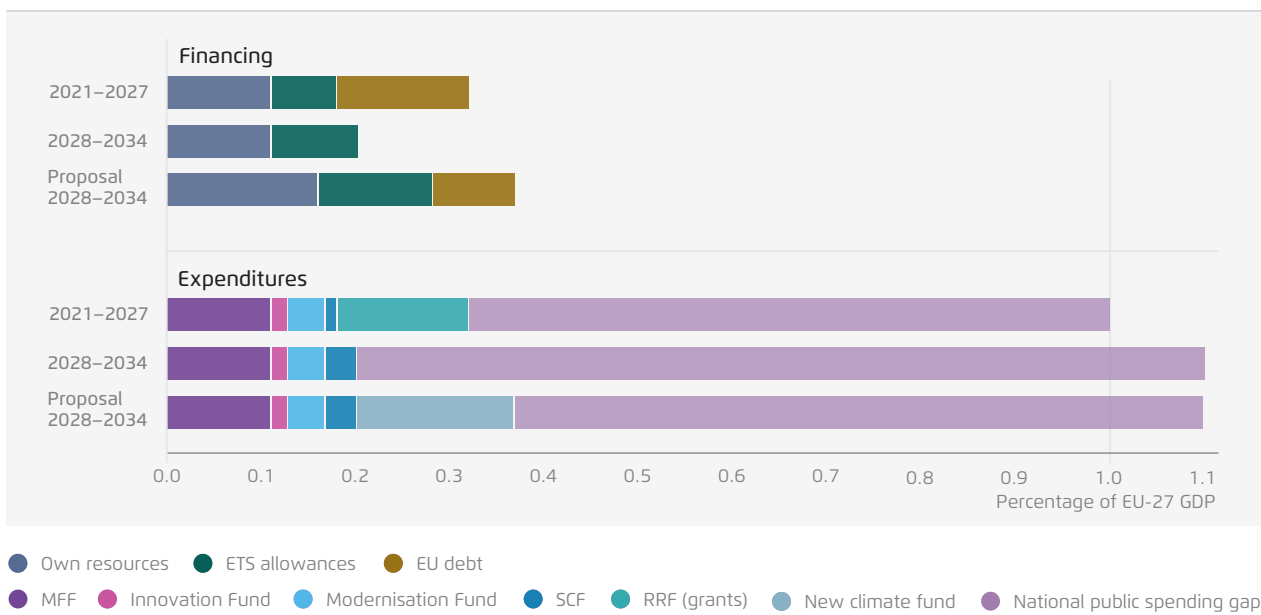
What needs to happen

1. Increase funding: The EU must increase its budget to meet the financial requirements of significant climate action, including investment in specific categories such as cleantech. This necessitates conducting an evidence-based assessment to determine the extent to which the budget should be expanded and the rationale behind this. We propose the establishment of a new EU climate facility to fill the void left by the RRF and to support the implementation of the Net-Zero Industry Act, commencing in 2028. This facility should be endowed with funding equivalent to just below 0.2 percent of the EU GDP per year. The new fund should build upon the outcome-based governance approach of the RRF and aim to incorporate over time the ETS-based Social Climate Fund and the Modernisation

Fund. This consolidation aims to mitigate fragmentation and enhance the effectiveness of climate financing initiatives.

2. Improve the allocation of funding: The incoming European Commission should establish a process to improve the coordination of climate investment across various MFF programmes and off-budget funds, which will entail aligning funding allocation more closely with sectoral and local investment needs. This earmarking should directly link to formalised climate investment plans which are based on impact assessments of sector- and country-specific investment needs. A more strategic allocation of funding allows for targeted investments and enhances the efficacy of EU climate spending. Simultaneously, it is imperative to track and regularly report on harmful spending, while also conducting a re-evaluation of the EU's climate tracking methodology to ensure that climate-focused funding is genuinely effective, especially concerning the CAP. Finally, EU funding programmes should mandate a significant level of national co-financing and promote good practices in national policies, especially in terms of the efficiency of public spending.

EU grant-based instruments for climate action and funding sources in current (2021–27) and next (2028–34) EU budget periods, Agora’s proposal for 2028–34 → Fig. 11



Agora Energiewende (2024). SCF: Social Climate Fund, MFF: Multiannual Financial Framework, RRF: Recovery and Resilience Facility

3. **Finance the increased spending:** This could entail a combination of strategies, including EU debt financing, the creation of new own resources, and increasing the individual contributions of Member States. With a well-defined strategy for

mobilising these resources, the EU can provide assurance to stakeholders that an expanded budget will be both sustainable and effective in promoting climate action.

Initiative 12: Address fiscal risks in the transition to climate neutrality

Why this is important

The resources allocated by national governments to climate investment fall significantly short of what is needed to achieve the 2030 EU climate targets. EU countries will have to cut more emissions over the next nine years than they have managed to cut during the past thirty years. We estimate that the additional green public spending requirements for the 2021–2030 period will surpass 1 percent of GDP per year in the EU. This contrasts with an average of only 0.2 percent of GDP per year in the Member States' recovery plans. The figure does not cover investment needs for climate change adaptation and other environmental areas (biodiversity, forest management, wastewater, and water management). These spending requirements come on top of what is needed for climate mitigation efforts.

While public spending needs can be reduced if governments rely more on carbon pricing and regulation, these options entail additional financing requirements to address social considerations and support structural transformation. In other words, even with governments maximising the use of private capital, implementing effective and just policies will require a significant increase in public spending. This additional funding is crucial to provide support to low-income households and small firms, as well to cover non-investment-related public expenses such as unemployment benefits and retraining programmes for workers in declining sectors. Decarbonising public assets, such as public buildings, will further contribute to significant increases in financing requirements.

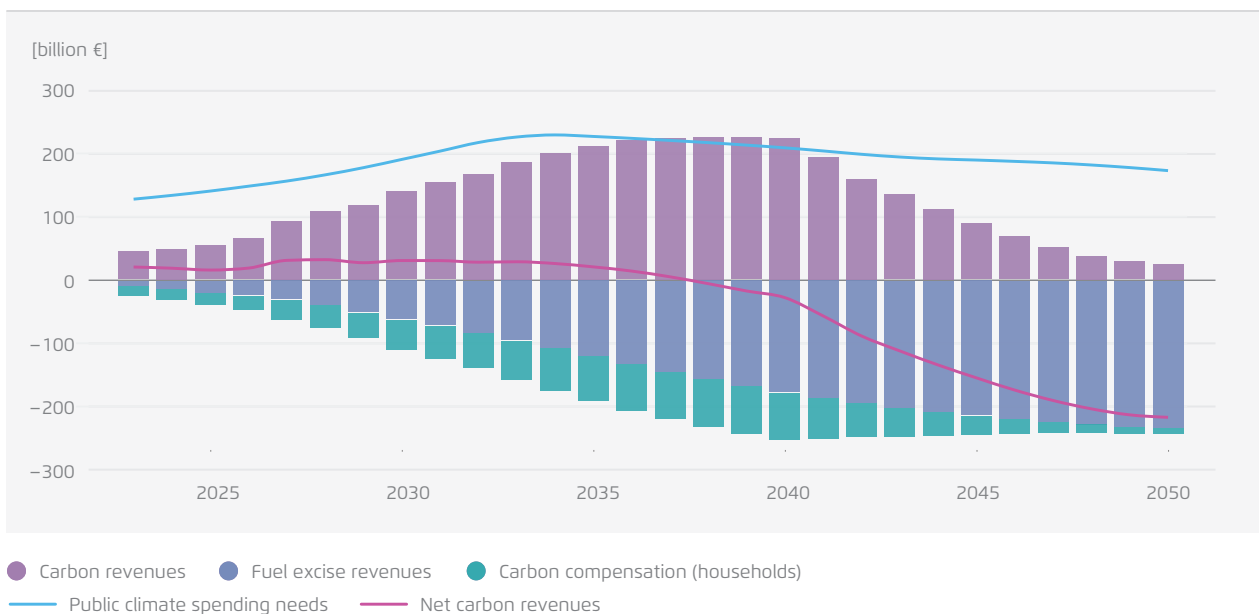
At the same time, the implementation of carbon pricing and the phase-out of fossil fuels will structurally alter national public budgets. For instance, the existing EU ETS yielded revenues of 29.4 billion euros for EU Member States in 2022, along with around 8.5 billion euros allocated to the Innovation and Modernisation Funds. The new ETS for road transport, building fuels and small industrial installations is expected to yield significant revenues starting from 2027. However, carbon pricing revenues may decrease unless prices remain aligned with declining emissions. Moreover, the shift toward electrification will gradually erode a large portion of the revenue that governments currently derive from taxes on motor and heating fuels (more than 2 percent of GDP in some Member States). This trend will put significant strain on national budgets throughout the 2030s, and consequently affect fiscal policy in several Member States.

These fiscal difficulties will be exacerbated by fiscal rules, such as the Stability and Growth Pact, which mandate consolidation in several Member States. The reform of the EU fiscal rules fails to adequately address the magnitude and scope of climate-related public spending, particularly when viewed in conjunction with investments in other EU public goods such as defence. The tension between the imperative to invest in climate action and the necessity to maintain public debt sustainability could be alleviated by increasingly financing these EU public goods collectively at EU level.

What needs to happen

- 1. Take EU public goods out of national fiscal straightjackets:** While the reform of the EU fiscal rules represents an improvement compared to the previous ones, it still imposes constraints on financing the large requirements of climate-related public spending. The incoming European Commission should propose an increase in EU funding for climate action. By assuming a significant portion of the public spending needs at EU level, this initiative could help alleviate the fiscal constraints faced by national governments.
- 2. Prepare Member States for a changing fiscal landscape:** The European Commission should initiate an EU-wide dialogue and review of fiscal revenues within the context of achieving climate neutrality, in particular focusing on the period beyond 2030. It should propose additional revenue sources to offset the declines in fossil fuel tax revenues. This could include introducing road charging schemes and expanding the scope of the EU ETS to include international aviation and non-CO₂ emissions. Moreover, the European Commission should prioritise incorporating the effects of meeting the EU climate targets into national budget plans and in the Debt Sustainability Analysis used within the reformed EU Economic Governance framework.

Changes in revenues and spending needs until 2050, relative to the 2015–2019 period, EU Gas Exit Pathway → Fig. 12



Agora Energiewende (2024) based on Oxford Economics modelling. Annual deviations from the 2015–2019 period, based on Agora's EU Gas Exit Pathway. Net carbon revenues are determined as the difference between the change in carbon revenues and the combined change in fuel excise revenues and compensation to households related to carbon costs.

Initiative 13: Design a quicker and more demanding post-crisis State aid framework

Why this is important

State aid refers to financial support (subsidies, tax breaks, interest-free loans, etc.) granted by a government or by public authorities to a company within the EU/European Economic Area (EEA). Generally, State aid is prohibited unless it is approved by the Directorate-General for Competition of the European Commission. This authorisation is required by the European Commission in order to safeguard competition and minimise distortions of the EU internal market. The Commission may approve State aid in many different situations, including where government intervention is necessary to ensure a well-functioning and equitable market. Rules on State aid can block or enable investments and thus shape how markets will evolve.

The European Commission recently revised its Guidelines on State aid for climate, environmental protection, and energy (CEEAG) in January of 2022 to align them with the European Green Deal.³⁰ Among other things, the reform broadened the categories of investments and technologies that Member States can support and imposed stricter limitations on the subsidisation of fossil fuels. However, despite some conditionality regarding fossil gas infrastructure and generation, the CEEAG still explicitly acknowledges a special role for fossil gas and permits both direct and indirect aid for investments based on fossil gas.³¹ The new rules also establish competitive bidding as the default award mechanism in most cases, and introduce compatibility rules to support the shift away from power generation based on coal, peat, and oil shale.

Due to the COVID-19 pandemic and the energy crisis, much of the more recent State aid linked to the Green Deal, provided by Member States, has been approved via special temporary State aid frameworks (Temporary Crisis and Transition Framework, TCTF). This has represented an unprecedented loosening of EU State aid rules. While temporary rules aimed at addressing the more short-term effects of these crises are set to expire by June 2024,³² their legacy includes the justification for significant untargeted and distortive subsidies to support fossil fuel prices in 2022 and 2023 (see Initiative 18). A recent revision of the TCTF also introduced new measures, effective until 31 December 2025, that are aimed at preventing a migration of green projects across the Atlantic in response to the US Inflation Reduction Act. The new rules provide EU Member States with more flexibility to compete with foreign countries by offering subsidies for the deployment and manufacturing of clean technologies (e.g. batteries, solar panels). This is investment aid that was previously prohibited.³³

Despite these reforms, several challenges persist within the existing EU State aid framework:

- Key provisions of the TCTF are set to expire at the end of 2025;
- State aid approvals for investments in clean technology are frequently a bottleneck due to complicated documentation requirements and staffing shortages;
- The CEEAG currently remain overly lenient regarding support for fossil gas and related infrastructure and cannot guarantee that the provided aid effectively reduces environmentally harmful activities and outcomes (e.g. GHG emissions); and

30 European Commission (2022), Questions and Answers, Guidelines on State aid for climate, environmental protection and energy 2022, https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_566 (accessed 21 February 2024).

31 The rules mandate that gas infrastructure be made “fit for hydrogen” and renewable gases. Investments in gas generation must commit to decarbonisation measures (e.g. CCS, hydrogen) or establish a timeline for closure of the installation.

32 European Commission (2023), Press Release, Commission adjusts phase-out of certain crisis tools of the State aid Temporary Crisis and Transition Framework, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_5861 (accessed 21 February 2024).

33 Under general State aid rules, aid facilitating industrial production is typically not permitted, except for initial investments in assisted areas (i.e. regions with low population density or abnormally poor areas), and even then, it must meet specific conditions.

→ The provisions for phasing out fossil fuels are largely limited to the power sector and require further adaptation to reflect emerging challenges.

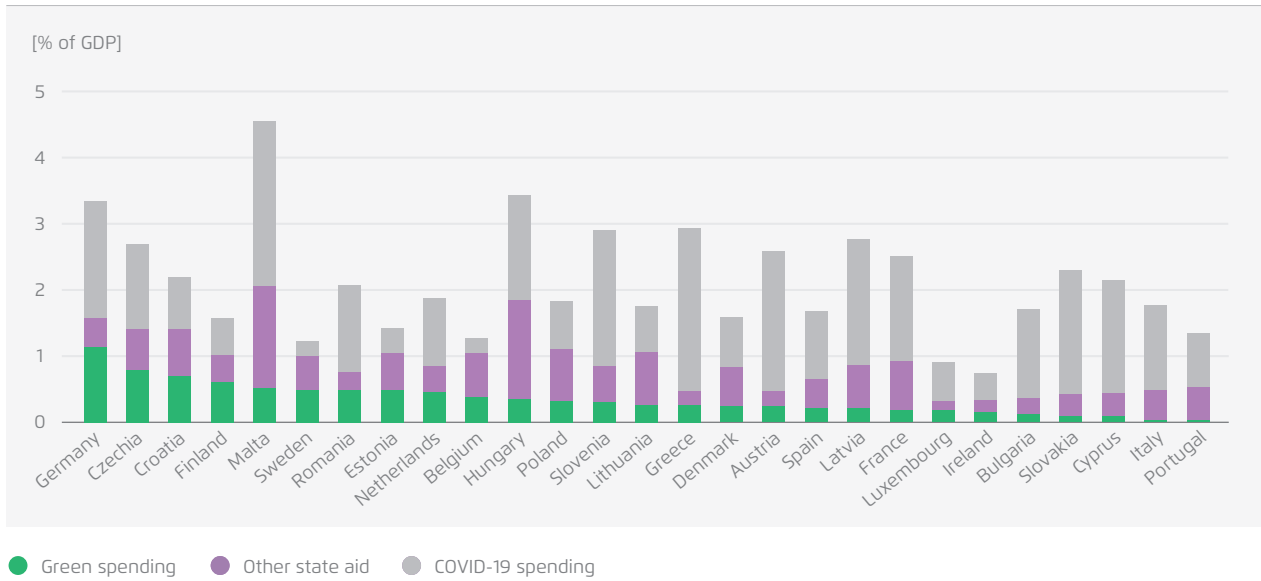
What needs to happen

1. **Create a long-term framework for government support to increase EU manufacturing for strategic net-zero technologies:** Relevant temporary EU State aid regulations supporting the manufacturing and deployment of clean technology should be extended beyond the current deadline (end of 2025) until the conclusion of the current EU budget period (2027). Furthermore, they should be updated again at the beginning of subsequent multiannual EU budget. Policy certainty is crucial for investors, as plants need regular reinvestment for proper functioning and to implement upgrades.
2. **Increase maximum aid limits to support clean-tech manufacturing in view of security-of-supply considerations and the need to achieve economies of scale:** For those cleantech manufacturing sectors requiring the largest support to meet the goals of the Net-Zero Industry Act, namely solar PV and batteries, competitiveness entails investing in larger plants to leverage economies of scale. While such higher national State aid is permissible according to the TCTF, it requires specific approval by the Commission and the demonstration that higher levels of aid are provided by a third country for an equivalent investment. Taking into account both security-of-supply considerations and the inherent rationale of achieving economies of scale for competitive cleantech manufacturing, it is advisable to reevaluate the maximum aid limits for such sectors in order to reduce their dependency on foreign policy.
3. **Facilitate the approval of net-zero strategic projects by revising the General Block Exemption Regulation and accelerating decisions regarding their compatibility with State aid disciplines:** The principle of technology neutrality should not be allowed to distract from the imperative of identifying, prioritising, and supporting the deployment of strategic technologies crucial for

the EU's transition to climate neutrality. As such, the General Block Exemption Regulation should be updated to enable automatic State aid approval for investments qualifying as net-zero strategic projects under the NZIA, provided that support remains within defined boundaries (intensity, thresholds, duration). Furthermore, the European Commission should increase staffing in the DG Competition units tasked with approving State aid for clean technologies and reduce the complexity associated with approvals linked to competitive processes.

4. **Revisit current State aid practice regarding infrastructure:** Current State aid rules consider the gas, electricity, and hydrogen grid as a natural monopoly, thereby exempting any financial aid given to TSO and DSOs from State aid scrutiny. However, several of the conditions listed in the current Guidelines on State Aid for Climate, Energy and Environment (CEEAG) to justify this exemption appear to be no longer relevant or applicable: The service to deliver energy through a pipeline/cable is in direct competition with alternatives, e.g. liquid fuels, ammonia, embodied hydrogen, on site storage and demand side reduction. Other operators than TSOs and DSOs are able and often also willing to invest in and operate such infrastructure, or provide alternatives to existing infrastructure. In this context, it should be re-evaluated whether the advantages of maintaining a natural monopoly with a regulated asset base undermine the business case of competitors (e.g. heat pumps, new green hydrogen and derivative producers, non-gaseous storage, and flexibility providers).
5. **Increase State aid conditionality for investments related to fossil gas:** Considering the absence of key concepts, methodologies, and standards for CCS and low-carbon hydrogen at EU-level (see Initiative 19), the European Commission should impose stronger conditions on the allocation of aid for initiatives related to gas infrastructure and end uses. This should encompass "hydrogen-ready" projects as well as carbon capture, utilisation, and storage (CCUS) initiatives. State aid should (a) be contingent upon the existence of a credible business plan that guarantees projects

State aid expenditure by Member State and type of spending as a percentage of 2021 national GDP → Fig. 13



Agora Energiewende (2024) based on European Commission State Aid Scoreboard data (2022): www.competition-policy.ec.europa.eu/state-aid/scoreboard_en

adhere to stringent sustainability criteria, (b) be preferably allocated to true net-zero-compatible solutions, and (c) feature a clawback mechanism to address instances where minimum performance requirements are not met.

- 6. **Extend State aid rules that support the transition away from fossil fuels:** Additional compatibility rules for State aid measures associated with a managed transition away from fossil fuel infrastructure outside of the power sector should be

developed. This should encompass initiatives for the decommissioning of gas infrastructure, the phasing out of refineries, and ensuring a just transition for the automotive sector.



Closing policy gaps

Under the European Green Deal the EU has significantly raised its climate ambition and adopted climate-relevant legislation at a scale, ambition and intensity that is unprecedented both for Europe and globally, making the EU a global leader on climate action. In the last four years, 80 legislative procedures relating to the European Green Deal have been completed or are close to adoption, related to all sectors and greenhouse gases. Implementing these new laws on the ground will be the central task and challenge of EU countries in the next policy cycle. Despite this impressive feat, some important issues have not been sufficiently addressed, leaving significant policy gaps that should be closed during the next policy cycle. The following policy initiatives would address these gaps.

Initiative 14: Put fair food environments at the heart of an integrated EU food policy

Why important:

While the EU food system has achieved high levels of food safety and availability, food-related challenges abound, with impacts on climate, the environment, and human health. An unhealthy diet is a leading risk factor for non-communicable diseases (NCDs), such as cardiovascular disease, type 2 diabetes, and different types of cancers. At the same time, more than half of the adult population across the EU is overweight or obese and no country is currently on track to halt and reverse this trend, despite international commitments to combat obesity.³⁴ This situation is further exacerbated by adverse socio-economic conditions. High food price inflation throughout 2022 and 2023 has led to a rise in the number of households unable to afford regular nutritious meals, impacting 8 percent of the EU population or over 36 million individuals in 2022.³⁵ Food-related health impacts show a clear social gradient. For instance, persons in the lowest quintile of income earners are about 50 percent more likely to develop overweight or obesity

than persons in the top income quintile.³⁶ The resulting costs to society are high, stemming from both healthcare spending and lost productivity.

Furthermore, food demand patterns are a driving force behind climate change and other adverse environmental impacts. An analysis by the Joint Research Centre found that food consumption in 2021 accounted for nearly 40 percent of the total climate footprint of EU consumption.³⁷ By impacting land demand for agriculture, food consumption patterns are also important drivers of biodiversity loss both in the EU and globally. Among food groups, animal products stand out due to their disproportionate contribution to these impacts, primarily because of their greenhouse gas emissions and land use intensity during production.

Food is indispensable and its production will inevitably affect ecological conditions. However, the food system can significantly enhance its contribution to the achievement of societally endorsed sustainability goals. A shift towards dietary patterns richer in plant-based foods and lower in animal foods, in

³⁴ World Health Organization (2022).

³⁵ Eurostat (2023), How many people can afford a proper meal in the EU?, <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230710-1> (accessed 22 February 2024).

³⁶ OECD (2019).

³⁷ Sanye Mengual, E. and Sala, S. (2023). Lifecycle assessment comparing the environmental impact of six consumption categories: food, mobility, housing, household goods, and appliances.

the context of healthy calory intake and reduced food loss and waste, is a key driver for substantially decreasing agriculture-related greenhouse gas emissions and achieving a more efficient use of land. The latter means that more space becomes available for other economic uses, such as for the bioeconomy, as well as for biodiversity preservation. Additionally, it will enable a reduction in the EU's global virtual land import, indirectly contributing to global food security. Such a scenario is poised to deliver significant benefits for health, through a decrease in diet-related diseases, as well as for the environment and public budgets. It can also yield further health benefits, particularly in terms of mitigating ammonia-related air pollution, reducing the global risk of the emergence and spread of infectious zoonotic diseases, and, when coupled with improved animal health, decreasing the risk of antimicrobial resistance (AMR).

Unlocking this potential requires a policy mix of measures aimed at creating fair food environments that support consumers in their move towards healthier, more plant-rich dietary patterns. Food environments are the “physical, economic, political, and sociocultural context” in which consumers engage with the food system to “make their decisions about acquiring, preparing and consuming food”.³⁸ Although largely beyond individual control, food environments exert significant influence on the foods consumed across society, for instance through the meals available in canteens and schools, the relative affordability of different products in retail settings, which foods are made desirable through online marketing and street-level promotions, and the presence or absence of easy-to-read and reliable consumer information on food packages.

Today's food environments are making it difficult for consumers to align their food behaviours with national dietary guidelines and enact common aspirations for healthy and sustainable consumption. In contrast, fair food environments are attuned to how people make decisions about purchasing and consuming food, facilitating healthy food choices as well

as those that are more compatible with social, ecological, and animal welfare goals. Enabling such choices involves enhancing the availability, affordability, and appeal of foods that contribute to healthier and more plant-rich diets.

Realising the economic, health, climate, and environmental benefits associated with a more sustainable food system will depend, to a significant degree, on achieving a gradual but significant shift in food consumption. Creating fair food environments will be critical for attaining this objective. This requires a paradigm shift in policymaking towards an integrated approach to food policy that pursues common sustainability objectives and addresses the different dimensions of food environments, beyond primarily focusing on consumer information. Such an approach should also ensure that policies are implemented at the most effective levels of governance, in a complementary and mutually reinforcing manner. At present, the EU lacks a policy framework to achieve this goal. While the Farm to Fork Strategy was as a step in that direction, some of its key initiatives, notably the legislative Framework for Sustainable Food Systems (FSFS), have not yet been published, leaving a large gap between societal needs and European policy.

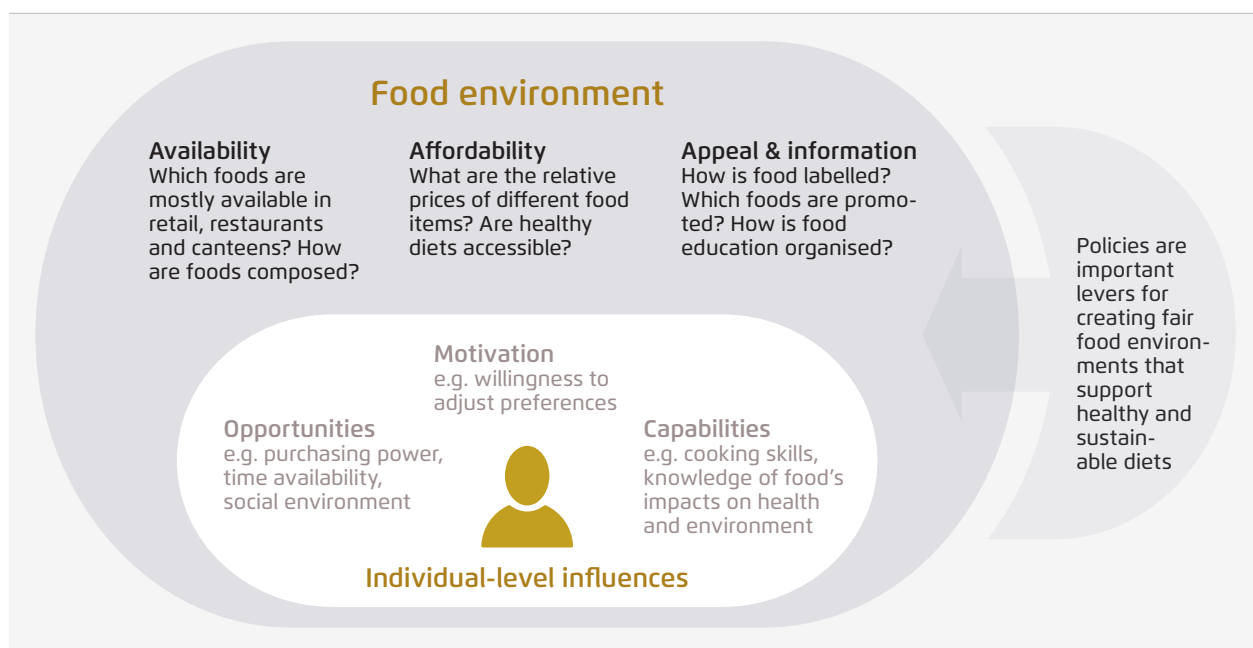
What needs to happen:

1. **Adopt a legislative framework for the advancement of a sustainable European food system:** Building on the work initiated under the EU Farm to Fork Strategy, this legislative framework should establish common objectives for food policies across Europe and drive policy development and integration across policy areas and levels of governance. This framework should not only contribute to empowering consumers but also enhance certainty for food businesses and farmers regarding long-term sustainability objectives. It should stimulate innovation and foster sustainability-driven competition within the internal market.
2. **Establish an EU platform for policies to advance fair food environments:** This platform should support the implementation of the framework

³⁸ HLPE (2017).

Creating fair food environments through integrated food policies

→ Fig. 14



Agora Agriculture (2024)

and accelerate the development of national food strategies and policies across the EU to create fair food environments. It should act as a goal-oriented platform, facilitating exchanges between Member States and regional authorities, and involve selected further stakeholders from various sectors within the food system.

- 3. Launch a fair food initiative:** The Commission should oversee an independent evaluation of the EU's current approach to tackling food

poverty among consumers and explore ways to strengthen it, including improving the monitoring of food poverty. Based on the outcomes of the evaluation and the instruments at the EU's disposal, the Commission should come forward with a Fair Food Initiative, potentially embedded as part of the European Pillar of Social Rights. The initiative should include an action plan to support Member States in expanding access to healthy and sustainable diets across the EU.

Initiative 15: Steer limited biomass supplies into priority uses for the transition

Why this is important

In 2017, 1.2 billion tonnes of biomass in dry matter were consumed in the EU. Of this, 50 percent was allocated to food, feed and bedding for livestock, 22 percent for energy and 28 percent for materials. Despite representing the smallest share of overall biomass demand, the use of biomass for energy (bioenergy) has increased significantly since the adoption of the first EU Renewable Energy Directive.

It continues to be regarded as a primary solution for replacing fossil energy in the EU climate and energy policies.³⁹ Notably, bioenergy is the main source of renewables today and is anticipated to play an

³⁹ Today, bioenergy accounts for around 60 percent of the renewable energy consumed in the EU. It is mainly utilised in heating for buildings and industry, power generation, and as a fuel in road transport, also due to the advantage of its compatibility with existing fossil fuel systems and infrastructure.

important role in reaching the updated 42.5 percent EU renewable energy target. However, recent system studies have highlighted a substantial gap between the biomass supply potential in the European Union on the one hand and the accumulated sectoral demand scenarios to meet climate neutrality by 2050, including carbon sinks, on the other. Biomass will face demand from many new sectors – bioeconomy, biomaterials, for industry feedstocks, construction materials, and finally also for carbon removals (bioenergy with carbon capture and storage, BECCS). Meanwhile, the supply of this biomass is increasingly being impacted by climate change (e.g. through increased water scarcity, forest fires, and insect plagues). Furthermore, its production and extraction can have negative impacts on biodiversity, the condition of ecosystems, and their capacity to sequester CO₂ from the atmosphere.

This growing “sustainability and availability gap” between projected biomass demand and supply has yet to be fully recognised by stakeholders and EU policymakers. Major parts of the EU Green Deal, the Fit for 55 package, the RePowerEU plan, the Gas Package and the Net-Zero Industry Plan have continued to promote bioenergy without due consideration for the potential future scarcity of the resources or conflicts with other policy objectives. Despite limited safeguards regarding the sustainability of bioenergy, (e.g. the newly introduced cascading rules and no-go areas for forest biomass), the significant increase in the EU renewables headline and sub-targets and the categorisation of bioenergy as eligible towards meeting these targets predominantly contribute to the current Renewable Energy Directive functioning as a driver of inefficient and indiscriminate demand for biomass for bioenergy purposes. While CO₂ emissions from biomass combustion in the EU-27 have risen from 210 million tonnes (Mt) in 1990 to 600 Mt in 2021,⁴⁰ the ETS and Renewable Energy (RES) Directive continue to categorise the combustion of biomass as zero-carbon, ignoring the emissions from burning the fuel. The European Commission has strongly promoted an aspirational biomethane target

of 35 billion cubic metres since the onset of the fossil energy crisis without conducting an impact assessment and or adequately considering sustainability safeguards. Moreover, there are currently no preventive measures in place to discourage the inefficient use of biomass (e.g. in low-temperature applications where electrification or other renewable options are viable). Nor are there measures to prioritise the limited future biomass supply for sectors with the highest efficiency and value added (e.g. industry, shipping, aviation).

In this context, there is a need for an integrated regulatory approach that bases decisions on a comprehensive understanding of future biomass demand. Such an approach should facilitate the balancing of various policy objectives (e.g. biodiversity conservation, enhancing industry competitiveness, ensuring security of supply, improving air quality, achieving food security, and implementing effective carbon sink policies). At the same time it should ensure that scarce land and soil resources are used in the most efficient way, considering that bioenergy requires 50 to 100 times more land than solar or wind energy alternatives.

What needs to happen

1. **Establish an EU biomass and land use strategy:** The debate surrounding the new 2040 climate target should be used to fundamentally reassess the role of biomass in EU climate and energy policy. To this end, the EU should develop a long-term biomass and land use roadmap by 2025/2026, ahead of the subsequent legislative package for the post-2030 climate and energy policy framework.

At the very least, this roadmap should:

- Identify sustainable biomass supply and demand potentials, categorised by types of biomass, while explicitly considering potential adverse climate impacts, biodiversity preservation, land use, and food security goals;

⁴⁰ EEA (2023): Greenhouse gases – data viewer.

- Identify policies that can help match future biomass supply and demand by prioritising limited biomass supplies for activities essential to the transition to climate neutrality;
- Be underpinned by comprehensive system modelling and a detailed, science-based impact assessment, providing stakeholders with a shared analytical framework for discussing future policies and regulations related to biomass.

Furthermore, the strategy should be used to fundamentally reevaluate the EU's current approach to biomass within its climate and energy policy framework:

2. Realign the EU's regulation of biomass with the objective of achieving climate neutrality. In this context, the following issues should be considered:

In this context, the following issues should be considered:

- Complementing or replacing Annex IX of the Renewable Energy Directive (RED), which identifies eligible feedstocks for advanced biofuels, with a comprehensive set of eligible feedstocks for all types of biomass and for use in all sectors that ensure substantial GHG reduction;
- Improving the monitoring, reporting, and verification framework for emissions from the combustion of biomass, including emissions from biomass imports;
- Changing the practice of categorising forest biomass as a zero-emissions energy source in the EU ETS, e.g. by taking into account net-emissions from burning biomass;
- Accelerating the reduction and eventual phasing out of food and feed crops from biofuel and biomethane production;
- Strengthening sub-quotas for e-fuels (renewable liquid and gaseous fuels of non-biological origin, RFNBOs) in shipping and aviation given the limitations of sustainable biofuels;
- Developing a strong sustainability framework for BECCS that incentivises carbon removal from biomass, while prioritising no-regret applications (e.g. biomass sourced from waste) and supply chains (e.g. short-rotation coppicing with local supply);⁴¹
- Reviewing existing State aid rules concerning activities related to biomass supply and utilisation;
- Developing provisions for biomethane leakage under the Methane Regulation;
- Exploring alternatives to increasingly complex sustainability certifications, such as demand-side limitations, capping permits for new bioenergy installations, and extending carbon pricing to the land use sector.

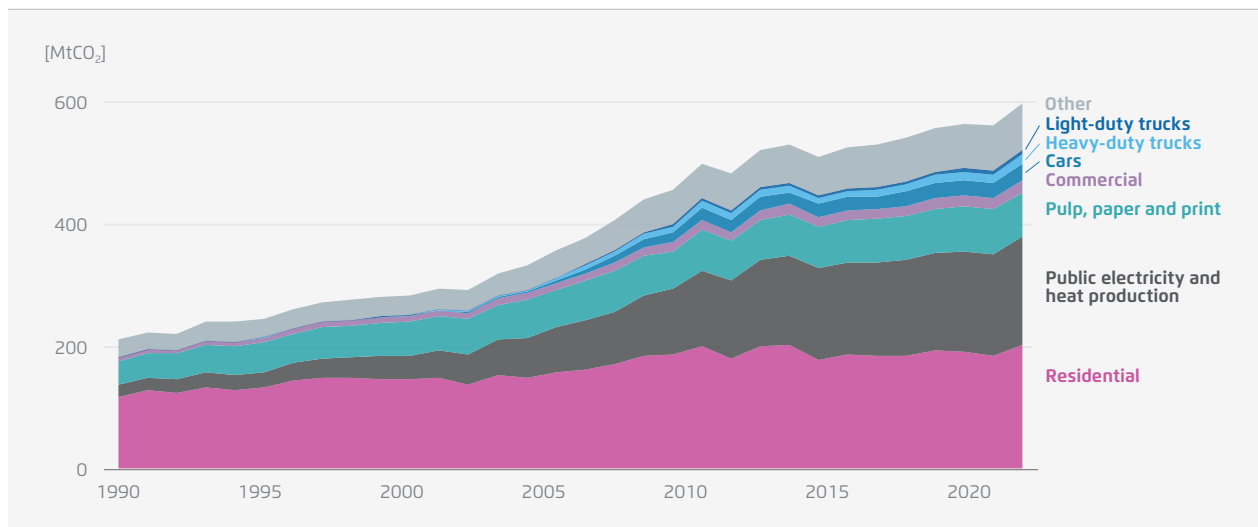
Based on this strategy and review, the EU and Member States should:

3. Adapt EU and national ambitions for bioenergy to reflect this prioritisation and incorporate the latter in the new NECPs for the period 2030–2040, due in 2029.

⁴¹ European Academies' Science Advisory Council (2022).

Carbon emissions from biomass combustion in the EU-27

→ Fig. 15



Cicero Center for International Climate Research (2023) based on data from the United Nations Framework Convention on Climate Change Common Reporting Format (UNFCCC CRF) Tables, EU, 2023.

Initiative 16: Establish an EU framework for scaling carbon removals

Why this is important

Achieving the Paris Agreement goal of limiting the global average temperature increase “to well below 2°C above pre-industrial levels” and fulfilling the explicit commitment outlined in EU Climate Law to attain climate neutrality by 2050 will require reducing fossil fuel emissions to near zero, holding residual “hard to abate” emissions in industry, agriculture, waste and transport to a minimum and compensating remaining and historical emissions through the active removal of CO₂ from the atmosphere. A recent review of scenarios conducted by the Intergovernmental Panel on Climate Change (IPCC)⁴² indicates that all pathways aimed at limiting warming to 1.5°C or 2°C entail some degree of negative emissions between now and 2050 (0.58 to 12 gigatonnes (Gt) of CO₂) and substantial levels of negative emissions by 2100 (450 to 1100 GtCO₂). Therefore, carbon removals will undoubtedly play an increasingly important role in EU climate action in the coming decades.

Currently, carbon dioxide removals (CDR) primarily consist of “conventional” land-based CDR, such as biogenic CO₂ that is naturally extracted from the atmosphere via photosynthesis and captured by plants and soils, notably in forests. More “novel” forms of CDR, which include bioenergy with carbon capture and storage (BECCS), direct air carbon capture and storage (DACCS), enhanced rock weathering, and coastal wetland management,⁴³ are far more costly and play a marginal role today. However, they are anticipated to become important components of carbon management in most climate neutrality pathways in order to achieve negative emissions and compensate for ongoing residual “hard-to-abate” emissions. Such “technical removals” also offer the advantage of providing more permanent storage, e.g. in deep geological formations, in contrast to natural storage in soils and forests on land (“carbon farming”). The latter are susceptible to non-permanence issues that may compromise their environmental integrity.

⁴² See the State of Carbon Dioxide Removal report, www.stateofcdr.org (accessed 21 February 2024).

⁴³ See the State of Carbon Dioxide Removal report, www.stateofcdr.org (accessed 21 February 2024).

In order to deliver on its political pledge to climate neutrality, the EU has begun to make specific political commitments to attaining negative emissions. In the recent reform of the Land-use, Land-use Change and Forestry (LULUCF) Regulation, the EU introduced a binding quantitative net-removal target for the LULUCF sector for the first time, set at –310 Mt of CO₂ equivalent. The EU Climate Law defines a maximum contribution of removals towards the EU 2030 climate target (–225 Mt), aiming to prevent carbon removal targets from diminishing the imperative to fundamentally reduce emissions. EU negotiators have recently agreed on a voluntary and EU-wide carbon removal certification framework. The Net-Zero Industry Act sets an EU objective to achieve an annual injection capacity of 50 Mt in strategic CO₂ storage sites in the EU by 2030. Moreover, the EU Innovation Fund has awarded grants to several CCS projects linked to unavoidable emissions in the cement and lime industry, along with at least one BECCS plant in Sweden.⁴⁴

Nonetheless, a substantial disparity is emerging between the current level of removals and the amount necessary to stay on course for climate neutrality. The capacity of European forests and soils to act as carbon sinks has significantly diminished in recent years and this downward trajectory could continue due to the impact of climate change and harvesting practices. Major efforts are thus needed to at least preserve natural sinks in forests, as well as to enhance emission reductions from land-use, for example through rewetting drained peatlands. Currently, there is also very limited practical experience with many of the CDR technologies that are considered promising options for future removals (e.g. BECCS and DACCS). If not addressed, obstacles such as a lack of technical expertise, limited access to funding, public acceptance issues, uncertain regulatory frameworks, and other barriers might impede their implementation.

In other words, given the scale of the necessary infrastructure deployment, failing to develop an adequate policy framework for carbon removals in the next European Commission could put the achievement of the EU's climate targets at risk. At the same time, achieving the required scale for CCS and "technical removals" demands a robust sustainability framework. This is essential to avoid unsustainable biomass utilisation or a delayed phase-out of fossil fuel emissions. It must sufficiently prioritise climate mitigation aiming to reduce our dependence on CDR to meet climate targets.

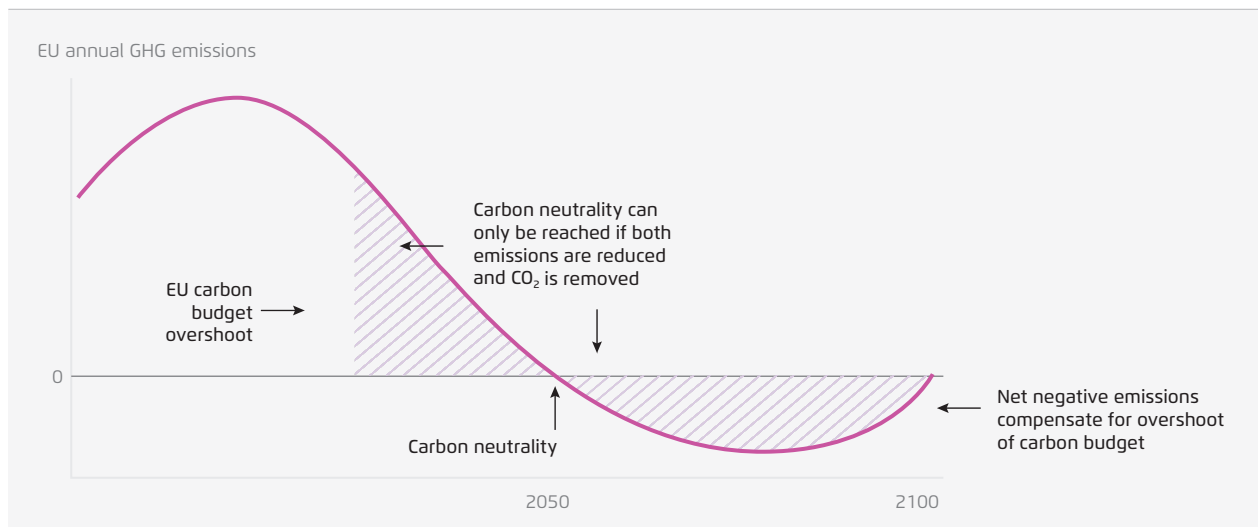
What needs to happen

1. **Introduce a robust certification framework:** Building on the voluntary carbon removal certification framework (CRCF), establish a robust certification framework for negative emissions before scaling markets for negative emissions (including in agriculture). This framework should address issues of permanence and additionality of the CO₂ removals, take into account CO₂ capture rates and other emissions released in the respective process chain, and be supervised by a Carbon Removal Certification Authority.
2. **Set ambitious but achievable carbon removal targets:** To ensure sufficient visibility to industry and land managers regarding the scaling of negative emissions within the post-2030 framework, the EU should set ambitious yet achievable targets for carbon removals. These targets should take the form of differentiated medium-term goals for both natural and technical carbon removals, set for the years 2035 and 2040.
3. **Set minimum emissions reduction targets:** To maintain a strong emphasis on climate mitigation within the post-2030 climate policy architecture, the future framework should establish either an explicit minimum emissions reduction target or an implicit target by capping the contribution of negative emissions towards the EU's 2040 climate target.
4. **Develop regulatory incentives for certified carbon removals:** The EU should create regulatory incentives for carbon removals tied to

⁴⁴ European Commission, Climate Action, Innovation Fund projects, https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/innovation-fund-projects_en (accessed 21 February 2024).

Permanent carbon removals compensate for carbon budget overshoot

→ Fig. 16



Agora Energiewende (2024) based on Carbon Reverse: www.reversecarbon.com/carbon-dioxide-removal

certificates in order to stimulate market-driven adoption of carbon removal technologies. In the context of the EU ETS this should be done by making it legally possible to create allowances for permanent removals (BECCS and DACCS) and/or establishing a separate carbon market overseen by a European Carbon Central Bank. This entity would issue negative emissions allowances and manage the net cap while ensuring environmental integrity. Issues related to the impermanence of carbon removals in land use (e.g. CO₂ in soils) and for embodied emissions in products should be addressed appropriately.

5. **Provide financing for the scaling of novel carbon removal technologies:** The EU should earmark funds from the EU innovation fund to finance initial commercial-scale BECCS and DACCS

demonstration projects. These projects would be financed through revenues generated by the EU ETS. It should also provide additional financial resources for this task, potentially in the form of a frontloading mechanism that would facilitate the development of projects using EU-debt financing, backed by anticipated future carbon pricing revenues.

6. **Develop a robust CO₂ infrastructure governance framework:** The EU should set rules governing the utilisation of CO₂ infrastructure to guarantee fair and prioritised access to CO₂ transport infrastructure and storage sites. Additionally, there should be regulations in place to oversee long-term management and address liability risks associated with CO₂ storage.

Initiative 17: Maintain momentum on international shipping and aviation

Why this is important

Aviation and shipping account for 2 percent and 4 percent, respectively, of the EU's total GHG emissions, but have experienced significant growth in the number of air passengers and the volume of international maritime trade over the last three decades. By 2019, emissions from aviation had surged by 146 percent

and those from shipping by 34 percent compared to 1990 levels. This is contrasted with a 25 percent decline in total EU emissions during the same period. Although emissions from both sectors experienced a significant drop in 2020 due to COVID-19 restrictions, by the summer of 2023, emissions had rebounded to pre-pandemic levels. Despite the

imperative for all sectors to reduce emissions, the demand for aviation and shipping is expected to continue growing.

Both international shipping and aviation are overseen by specialised UN agencies: the International Maritime Organisation (IMO) and the International Civil Aviation Organisation (ICAO), respectively. Each agency has developed its own set of regulations and strategies to mitigate and report GHG emissions within its respective sector. The IMO focuses on reduction targets and data collection for shipping, while the ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) involves offsetting emissions growth in international aviation. However, realising higher climate ambition in international shipping and aviation within ICAO and IMO encounters various challenges. These include the cross-border nature of emissions, complexities in emission accounting, divergent national priorities, lengthy regulatory timelines, reliance on carbon offsetting, technological hurdles, global equity debates, and the absence of robust enforcement mechanisms. These complexities impede the swift adoption of comprehensive and stringent measures, underscoring the imperative for EU leadership.

Under the Paris Agreement, the vast majority of anthropogenic GHG emissions fall within the scope of Nationally Determined Contributions (NDCs). This includes emissions from shipping and aviation, but only within the respective jurisdiction (i.e. domestic emissions). Despite their significant contribution to overall emissions, most country NDCs do not incorporate GHG emissions from international maritime and aviation transport. Similarly, although the new EU NDC includes some international transport emissions, the EU's 2030 climate target is defined as a purely domestic one.

Nonetheless, the EU has taken important first steps to tackle these emissions. It has incorporated domestic aviation into the EU ETS since 2012 and adopted significant new policies aimed at reducing emissions from both airplanes and ships as part of the Fit for 55 package. These encompass the inclusion of maritime transport into the ETS, extending reporting

obligations to 50% of international voyages, a revision of the scheme for aviation, as well as proposals for more sustainable fuels for planes and ships. These reforms will lead to a significant expansion of carbon pricing for aviation and maritime transport emissions, along with the phase-out of free allocation for aviation by 2025. They will also generate significant new revenues to support the development of sustainable aviation fuels and technology innovation in shipping and aviation (45 million ETS allowances). Additionally, the reforms will introduce new sustainable aviation fuel targets (2 percent in 2025, rising to 70 percent by 2050) and new GHG intensity reduction targets for marine fuels (2 percent in 2025, rising to 80 percent by 2050).

However, there are still important gaps that need to be addressed, and these should be a priority for the next European Commission. While efforts to tackle emissions from aviation and shipping have focused on CO₂ emissions only, the recent revision of the EU ETS has extended the scope of the instrument to non-CO₂ emissions from maritime transport (methane and nitrous oxide) starting from 2026 and opens the possibility for a future legislative proposal to incorporate non-CO₂ effects from aviation into the EU ETS by 2027. Addressing non-CO₂ effects is particularly crucial from a climate perspective in aviation, as they are estimated to account for two thirds of aviation's total climate impact.⁴⁵ These impacts can be significantly mitigated at minimal cost by making kerosene cleaner (reducing aromatic and sulphur content) and slightly adjusting flight routes to avoid regions of the atmosphere prone to cloud formation due to particle emissions in cold and humid conditions.

Furthermore, aviation and marine fuels continue to be largely exempt from energy taxation at EU level under the Energy Taxation Directive. Additionally,

⁴⁵ Transport & Environment (2020), Airline contrails warm the planet twice as much as CO₂, EU study finds, www.transport-environment.org/discover/airline-contrails-warm-planet-twice-much-co2-eu-study-finds (accessed 21 February 2024).

only part of CO₂ emissions from international maritime and aviation activities are currently included in the scope of the EU ETS.

What needs to happen

1. Include international transport in the EU 2040 climate target and maintain EU leadership:

Incorporating international transport within the scope of an EU 2040 target decreases the relative emissions reduction achievable by 2040. For example, the reduction may reach 88 to 92 percent when including international transport, compared to 90 to 95 percent when only considering domestic transport. This discrepancy arises because emissions from international transport are expected to decrease at a slower pace than those from other sectors within this timeframe. While 2040 targets excluding international transport may appear more ambitious based on the percentage reduction, this approach comes at the expense of not addressing a substantial share of residual emissions. Therefore, it is imperative to include international transport in the EU 2040 climate target to sustain policy momentum in this domain. Furthermore, while global policies are better suited for a global sector, the ICAO has implemented CORSIA with little ambition and has no climate policies in place after its expiration in 2035, and the IMO has been notoriously slow in taking climate action. Consequently, EU policy action to address international transport emissions remains crucial for the foreseeable future; the EU cannot afford to wait for the ICAO or the IMO.

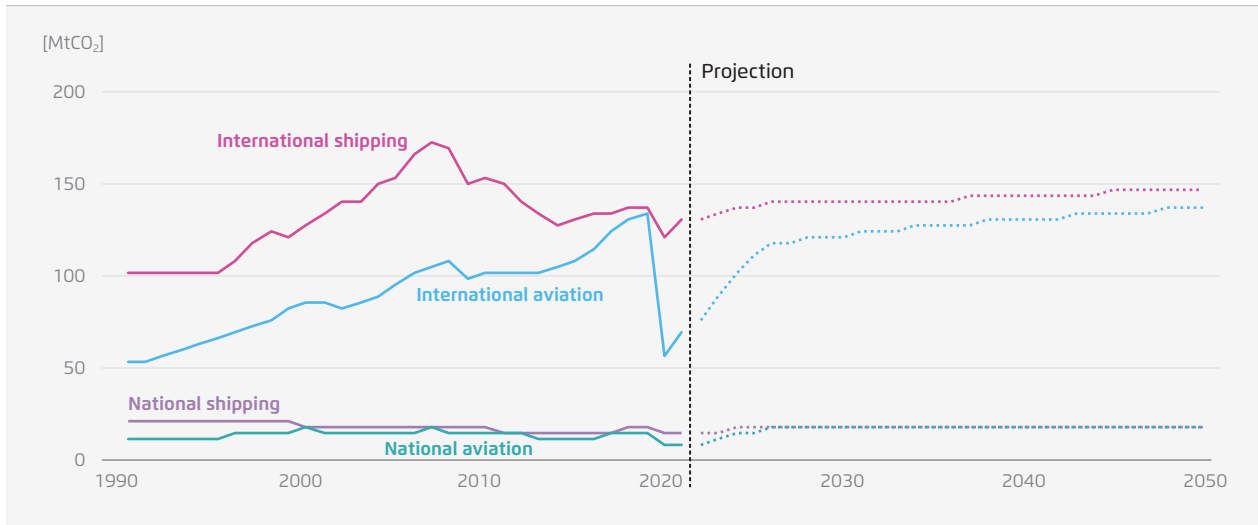
2. Incorporate international flights and non-CO₂ emissions from aviation into the EU ETS: Currently the EU ETS only encompasses intra-EU flights, even though most aviation emissions arise from long-haul flights. Therefore, incoming and outgoing flights should be incorporated in the next ETS revision, as it is highly probable that the current approach under CORSIA will not achieve sufficient emission abatement. Furthermore, it

is crucial to include non-CO₂ emissions from aviation in the EU ETS and ensure ambitious implementation of this measure.

3. **Take further action on non-CO₂ effects from aviation:** To minimise non-CO₂ emissions from aviation, additional and complementary regulatory measures should be implemented. These should involve introducing a European clean kerosene standard to regulate the fuel quality of aviation fuels (reducing aromatic and sulphur content). Additionally, adopting new regulatory options to encourage flight paths that minimise contrail formation would be beneficial. As a first step, the Commission must ensure that the already agreed monitoring of non-CO₂ emissions is rigorous.
4. **Further strengthen the EU ETS for the maritime sector:** The EU should utilise the scheduled reviews of the EU ETS for maritime emissions to extend the coverage, increase ambition, and address potential policy implementations at the IMO.
5. **Strengthen ReFuelEU Aviation and FuelEU Maritime:** Biofuels can play a limited role in ships and planes, but come with significant sustainability risks and cannot be produced at scale due to competing uses and limited biomass feedstocks. As a result, the scaling of e-fuels – such as e-kerosene for aviation, and e-ammonia and e-methanol for shipping – must be further incentivised. In this context, the EU should strengthen the RFNBO sub-target in ReFuelEU Aviation and consider the introduction of a more ambitious and progressively increasing obligation on fuel suppliers for maritime fuels.
6. **Introduce minimum taxation on jet and marine fuels:** The exclusion of aviation and marine fuels from energy taxes is an unresolved problem. While negotiations on the revision of the energy taxation directive are ongoing, like-minded countries could and should take proactive steps by taxing (international) aviation fuels through bilateral agreements. Revenues generated from this taxation should complement ETS revenues, supporting the scaling of sustainable aviation and/or marine fuels respectively.

Historic and projected CO₂ emissions from EU-related aviation and shipping for national and international cruises

→ Fig. 17



Oeko-Institut (2024): *Aviation in the EU climate policy: Key issues for the EU 2040 and 2050 targets* (forthcoming), based on European Environment Agency (2023): *Trends and projections in Europe 2023*. Note: Projections only include existing measures (business as usual)

Initiative 18: Prepare for the fossil fuel phase-out

Why this is important

The conclusions from the first Global Stocktake, as agreed at the UN COP28 climate summit, officially acknowledge the imperative to stop burning fossil fuels. The report urges countries and stakeholders to accelerate the phase-out of unabated coal power and transition away from fossil fuels in energy systems. It marks the first formal recognition in UN climate negotiations that achieving climate neutrality and meeting the temperature goals outlined in the Paris Agreement necessitates an end to the burning of unabated fossil fuels. This means no oil, no coal, no fossil gas.

Discussions on phasing out fossil fuels are already underway at both the EU and national levels and have made significant progress since the launch of the EU Green Deal. As of December 2023, all EU Member States with coal generation – with the exception of Poland – have committed to explicit policy measures aimed at phasing out the use of coal in electricity generation. These commitments come with end dates ranging from 2025 to 2038. The recently revised EU CO₂ standards for cars and vans effectively mandate

cessation of new fossil-fuel vehicle sales by 2035. Similarly, the revised Energy Performance of Buildings Directive requires Member States to plan for a complete phase-out of fossil fuel boilers by 2040. Moreover, the REPowerEU plan from May 2022 includes ambitious measures aimed at enabling the EU to become independent from Russian fossil fuels well before 2030.

These objectives are further reinforced by a significant strengthening of the EU’s ETS for power and industry, along with the introduction of a new ETS for buildings and transport. As adopted, the emissions cap established within the two emissions trading schemes would de facto end the use of “unabated” fossil fuels in the covered sectors by 2039 and 2044, respectively. Even before these dates, fossil fuel prices are likely to increase significantly, rendering fossil fuel usage progressively uncompetitive – especially coal and oil.

Despite these recent global commitments and policy developments under the EU Green Deal, the EU has not yet made a formal commitment or developed a plan for a complete transition away from fossil fuels.

This lack of commitment may entail potentially costly and disruptive consequences for consumers and affected workers.

In addition, Member State efforts to phase out harmful fossil fuel subsidies are currently wholly inadequate. According to a study for the European Commission,⁴⁶ fossil fuel subsidies in the EU surged from 56 billion euros in 2021 to 123 billion euros in 2022, and have remained at similar levels, around 110 billion euros in 2023. This is money that could otherwise be allocated to support clean investments, e.g. clean heating and transport.

Finally, the EU remains at risk of further fossil fuel lock-ins. Limited safeguards have been adopted or proposed to mitigate the risk of overbuilding Liquefied Natural Gas (LNG) supply infrastructure and establishing long-term contracts for fossil fuels. In fact, the EU has largely replaced its dependence on Russian fossil gas with LNG deliveries from other suppliers (in particular the US), rather than through structural reduction in fossil gas demand (e.g. through renewable energy deployment, direct electrification, and energy efficiency measures).

What needs to happen

1. **Enshrine fossil fuel phase-out in the EU Climate Law:** The EU must include the explicit objective of phasing out fossil fuels by 2050 within the EU Climate Law. Additionally, it should establish a jointly determined target for fully eliminating fossil fuel subsidies from both national and EU expenditure. This latter goal should be supported by strict State aid guidelines governing support for fossil fuel-related infrastructure such as CCS and “hydrogen-ready” pipelines (see Initiative 13).
2. **Prepare an EU fossil fuel phase-out strategy:** The EU should develop a fossil fuel phase-out roadmap, delineating key milestones towards achieving a complete EU-wide transition away from fossil fuels by 2050. Simultaneously, it

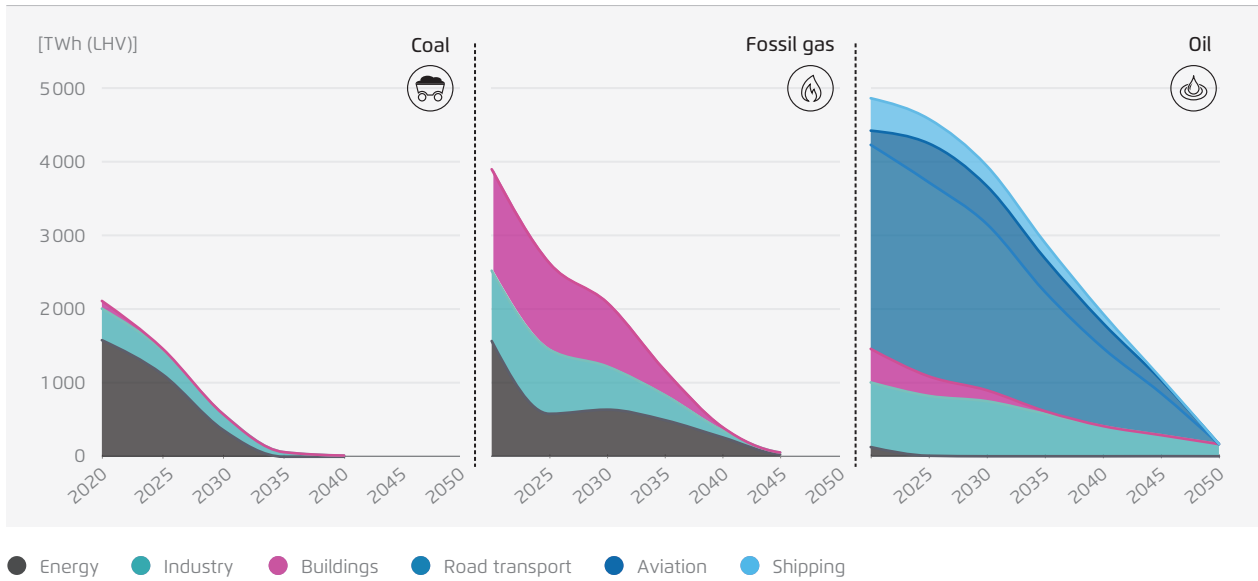
should reaffirm the REPowerEU objective to phase out imports of Russian fossil fuels before 2030. This strategy should incorporate a review of the EU’s just transition framework concerning industries impacted by the fossil fuel phase-out. It should also assess the need for additional regulation of existing fossil fuel assets in order to prevent sudden disruptions to the provision of energy services (e.g. due to the premature closure of critical power plants, refineries, and fuel stations).

3. **Develop a regulatory framework for the managed phase-out of fossil fuel infrastructure:** Building on the EU fossil fuel phase-out roadmap and the anticipated distribution network development plans outlined in the Gas Directive, policymakers should revise existing energy legislation. This reassessment should focus on establishing a regulatory and planning framework for the managed decommissioning of existing gas assets.
4. **Integrate fossil fuel phase-out into national plans:** The National Energy and Climate Plans, as outlined in the Governance Regulation, are the result of an iterative policy-making process. Each of these documents is to be updated for the 2031–2040 period, with revisions due by 1 January 2029. Member States should leverage this strategic policy process to prepare for the phase-out of fossil gas across all key sectors (energy, industry, buildings, and transport). More immediately, Member States should utilise the National Building Renovation Plans, expected to be in place by the end of 2026, to assess which policies and measures are necessary to achieve a phase-out of fossil fuel boilers by 2040.
5. **Avoid LNG overcapacity and long-term LNG offtake agreements beyond 2049:** As part of the Net-zero Infrastructure Plan (see Initiative 10), the EU should conduct a thorough assessment of the adequacy of both existing and planned LNG supply infrastructure. Moreover, it should grant the Agency for the Cooperation of Energy Regulators (ACER) a regulatory mandate to oversee the development of LNG supply infrastructure. Additionally, ACER should be empowered to

⁴⁶ European Commission (2023c).

Fossils phase-out: Energy consumption by fossil fuel and sector in TWh, EU-27, Agora EU Gas Exit Pathway

→ Fig. 18



Agora Energiewende (2024) based on Agora Energiewende (2023): *Breaking free from fossil gas. A new path to a climate-neutral Europe.*
 Note: Oil data includes international transport and non-energy consumption (e.g. chemical feedstocks in industry). LHV: lower heating value.

enforce the new provision in the Gas Package, which prohibits long-term contracts for fossil gas from extending beyond 2049.

6. **Regulate methane emissions from imports of fossil fuels:** The EU must implement ambitious methane leakage requirements and benchmarks

for imported fossil fuels, as outlined in the Methane Regulation. This is essential to ensure that the residual fossil fuels consumed in the EU between 2030 and 2050 adhere to increasingly strict performance standards.

Initiative 19: Fill the regulatory gaps around low-carbon gases

Why this is important

Renewable gases, in particular hydrogen, will play an important role in helping to decarbonise hard-to-abate energy end uses, such as chemical feedstocks, steel production, and high-temperature process heating. Demand for renewable hydrogen and its derivatives is expected to account for between 19 and 32 Mt in 2040 and around 60 Mt in the modelling for the recent 2040 climate target impact assessment. This anticipation is consequential, considering that renewable hydrogen is currently significantly more expensive than its fossil fuel or direct electric competition and virtually non-existent.

In line with these projections, the EU has implemented various measures during the current legislative cycle to bolster the expansion of renewable gases. These initiatives include the EU Hydrogen Strategy, the establishment of an Important Project of Common European Interest (IPCEI) for hydrogen, the creation of the European Hydrogen Bank, setting sub-targets for Renewable Fuels of Non-Biological Origin in the Renewable Energy Directive, launching the ReFuelEU Aviation Initiative, and providing significant financial backing through EU funds. Despite these efforts, several gaps persist that need to be addressed to facilitate the sustainable growth of renewable gases.

Firstly, the EU must revise its unrealistic aspirational targets of 20 Mt of green hydrogen and 35 bcm of biomethane by 2030, as outlined in the REPowerEU plan. Although these targets were never officially endorsed as legally binding or subjected to formal impact assessments, they have remained an important reference point in the EU's political discourse. Moreover, they have influenced the formulation of the more recent ten-year EU energy infrastructure plans, despite appearing largely unachievable within the specified timeframe in a sustainable manner. Hydrogen and biomethane are expected to remain scarce resources for the foreseeable future, necessitating their strategic allocation to high-value applications (e.g. industry, shipping, and aviation) while diverting them from less energy- and land-efficient options. This allocation is crucial to ensure effective decarbonisation and enhance energy security. However, these overly ambitious targets have acted as a significant distraction, fostering the misconception among policymakers that new renewables gases will be both affordable, environmentally friendly, and readily available at scale within the required timeframe.

Secondly, the EU has failed to set sufficiently robust sustainability criteria for low-carbon gases. While precise criteria and assessment methodologies for evaluating the sustainability of non-bio-based renewable hydrogen have been implemented, similar standards are still absent for so-called "low-carbon" hydrogen and gases based on nuclear power, biomethane or fossil fuels with carbon capture and storage. This means that the production of green hydrogen currently competes against fossil-based production without net-zero compatible requirements, even for the limited public funding allocated to clean hydrogen through State aid and in EU budgets.

Furthermore, the regulatory gap pertaining to fugitive emissions from biogas as well as biomethane emissions has not been addressed in the recently agreed Methane Regulation, which exclusively focuses on oil, coal, and gas. As a result, while biomethane is accounted for upon injection into the grid, the leaky production stage of these gases remains unregulated.

Recent scientific research⁴⁷ suggests that decentralised biogas and methane production may have leakage rates that could be significantly higher than previously assumed. Consequently, any scaling up of these processes must be accompanied by comprehensive monitoring and leak detection measures from the outset.

Scaling renewable gases in a sustainable and cost-efficient manner requires the EU's ongoing leadership in this area, while also correcting these shortcomings.

What needs to happen

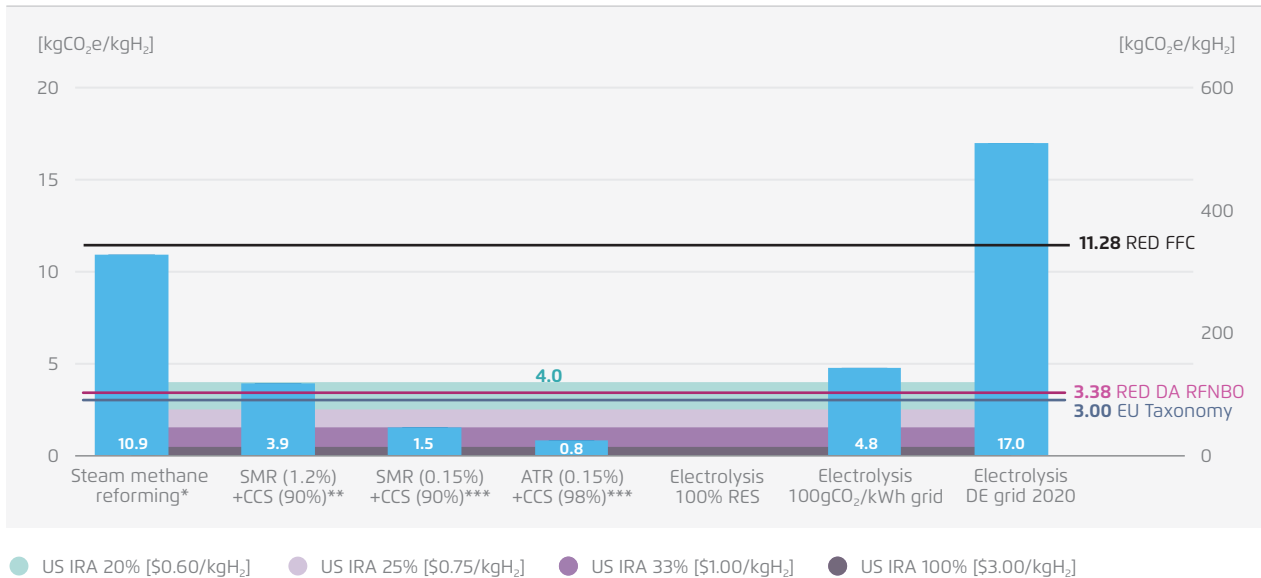
1. **New renewable gas targets:** A new impact assessment is needed to revise the REPowerEU targets and establish more realistic and attainable goals for 2030 and 2040. This assessment should correct methodological flaws in the modelling for the EU's REPowerEU strategy that inadvertently hinder electrification in transport and heating, diverting around approximately half of the hydrogen demand into non-priority sectors such as residential heating.
2. **Establish strict sustainability criteria for low-carbon gases:** The European Commission should urgently address the regulatory gap concerning low-carbon gases and hydrogen. In formulating emission intensity thresholds and related certification for fossil-based low-carbon gases and hydrogen, it is essential to ensure that neither fossil power production nor fossil gas production is incentivised to expand. Additionally, robust certification for carbon storage must be implemented. Hydrogen must attain verifiable low-carbon intensities that progressively approach zero by 2030.⁴⁸ Achieving this requires high carbon capture rates, permanent underground storage of carbon, and minimisation of methane leakage.

⁴⁷ Imperial College London (2022).

⁴⁸ As stipulated by the IEA in its *Breakthrough Agenda Report 2022*.

3. **Strengthen regulatory requirements on methane leakage from biomethane:** The Commission must revise the Methane Regulation to incorporate rigorous measurement, reporting, and verification of emissions associated with biomethane.
4. **Require the use of sustainable feedstocks in the production of biogases:** The sustainability criteria in the recently revised Renewable Energy Directive restricts feedstocks for biomethane production primarily to waste and residues solely when used as a transport fuel. More generally, the sustainability criteria for biogases are still largely based on provisions initially formulated for liquid fuels, rather than gaseous fuels. As such, similar sustainability criteria do not apply when the biogases are used in heating and industry, an omission that should be corrected.
5. **Introduce a new methane fee:** The proposed fee should be levied on upstream methane emissions within the fossil oil and gas sector, applicable to both imports and exports. Its implementation would generate revenues for climate action and provide an incentive for fossil fuel producers to adopt best practices to avoid methane leakage, consistent with the 'polluter pays' principle. Moreover, it would aid in facilitating the implementation of the EU Methane Regulation.

Carbon footprints (right axis) and emissions thresholds (left axis) of hydrogen production pathways and standards → Fig. 19



Agora Industry (2024), based on data from the Energy Transitions Commission (2021): *Making the hydrogen economy possible – Accelerating clean hydrogen in an electrified economy*; the European Commission's Joint Research Centre (JRC). Note: Electrolysis pathways excl. equipment manufacturing emissions. Electrolysis efficiency 70%. For comparison, the carbon intensity of the German power grid in 2020 was 356g CO₂e/kWh [JRC]; ATR: autothermal reforming, CCS: carbon capture and storage, DE: Germany, RED: EU's Renewable Energy Directive, RED DA RFNBO: RED Delegated Act on Renewable fuels of non-biological origin, RED FFC: RED fossil fuel comparator, RES: renewable energy sources, LHV: lower heating value; United States' Clean hydrogen production standards (CHPS): 4.0 kg CO₂e/kg H₂ – credit: 20% of \$3/kg H₂ when between 2.5 and 4 kg; 2.5 kg CO₂e/kg H₂ – credit: 25% of \$3/kg H₂ when between 1.5 and 2.5 kg; 1.5 kg CO₂e/kg H₂ – credit: 33.4% of \$3/kg H₂ when between 0.45 and 1.5 kg; 0.45 kg CO₂e/kg H₂ – credit: 100% of \$3/kg H₂ when below 0.45 kg. *CertifHy state-of-the-art SMR benchmark lifecycle emissions. **1.2% leakage rate (e.g. Russian gas, 5 000 km transport) [ETC 2021]. ***0.15% leakage rate (e.g. Norwegian gas, 1 700 km transport) [ETC 2021].



Adapting to a changing geopolitical landscape

The EU stands at a pivotal moment for its external trade relationships on energy, shaped by a changing geopolitical landscape. Russia's invasion of Ukraine has not only led to a war at the EU's doorstep but has triggered a domestic energy crisis. Conflict in the Middle East is introducing volatility to global energy markets, disrupting crucial trade routes. Political turbulence in the US risks further altering the transatlantic relationship, as the EU becomes increasingly dependent on the US for LNG. This confluence of events takes place against the backdrop of an eroding rules-based multilateral trading order.

Meanwhile the ongoing energy transition from fossil fuels to clean technologies necessitates a reassessment of energy security. The EU's response to the sudden disruption in supplies of fossil fuels from Russia was reactive and immensely costly. The EU needs a more forward-looking approach, shifting from temporary quick fixes to more gradual structural measures, such as investments in renewables such as wind and solar and energy savings such as heat pumps and building renovations, to permanently reduce fossil fuel demand and mitigate volatility. As the EU transitions from fossil fuels to renewables, new external trade dependencies will also emerge, for hydrogen, hydrogen derivatives and materials. Securely managing these dependencies will require establishing robust new trade partnerships.

Initiative 20: Set a geopolitical strategy for Europe's transition to climate neutrality

Why this is important

The EU is entering a critical decade for its climate ambitions amid turbulent geopolitical dynamics.

This context exerts varying influences on Europe's energy and industrial transitions. Firstly, the proliferation of conflict flashpoints introduces price volatility and inflationary pressures, prompting calls for monetary tightening that adversely affects investments. Secondly, the escalating contestation surrounding supply chains fuels a desire for their restructuring, driven by geopolitical considerations. This raises concerns about the increased costs associated with accessing clean energy and material inputs, along with broader worries about industrial competitiveness as Europe's main competitors engage in security-driven subsidy races for clean technologies. Worryingly, such a tendency is difficult to mitigate within an increasingly eroded multi-lateral rules-based trade order. Lastly, a widening

North-South divide is emerging. Measures such as the CBAM, along with Europe's outbidding of developing countries in the LNG race following the energy crisis in 2022, have contributed to further exacerbating long-standing tensions. This divide poses a challenge for cooperation on decarbonisation efforts, particularly within a more fragmented and multipolar economic order.

Against this backdrop, the limitations of the current external energy strategy are becoming apparent.

Initially issued in May 2022, the strategy was crafted in response to the gas supply crisis in Europe following Russia's war against Ukraine. Driven by the urgency to find alternative gas producers, the strategy has not sufficiently taken into account the prospects for a structural decline in fuel imports. This oversight results in conflicting messages for suppliers and investors, potentially leading to asset stranding or carbon lock-in in Europe and beyond.

Furthermore, the external energy strategy presents a narrative for external cooperation that proves challenging to implement, particularly concerning the anticipated international trade in renewable hydrogen. Mounting evidence suggests that initial assumptions regarding costs, availability, and the logistical challenges associated with transporting hydrogen over long distances were overly optimistic. These misplaced assumptions, exemplified by the unrealistic objective of importing 10 Mt H₂ annually by 2030, reveal a supply-side bias driven by an emergency response to the evolving energy landscape. However, considering hydrogen as a swift substitute for natural gas, despite its more complex supply chain and uncertain demand landscape, as well as the aspirations of prospective exporters to develop downstream segments of the hydrogen value chain, risks leading to poor infrastructure planning and confusion among key prospective foreign partners regarding hydrogen.

Thirdly, the external energy strategy is out of sync with a changing policy and institutional context. The potential emergence of new dependencies resulting from the surging demand for critical minerals and materials is now being addressed through the recently enacted Critical Raw Materials Act. Simultaneously, the Net-Zero Industry Act aims to strike a balance between the EU's industrial interest in expanding clean technology manufacturing domestically and the imperative to maintain an open international trading system for clean technology products. Moreover, the EU has undertaken several new global commitments on climate and energy since the adoption of the strategy – notably, committing to tripling renewable energy and doubling energy efficiency by 2030. Lastly, the escalating political instability at the EU's borders underscores the urgency of formulating a viable offer for energy and climate cooperation in the neighbourhood.

What needs to happen

Early in its mandate, the European Commission should initiate a comprehensive update of its external energy strategy. The objective should be to develop a consistent engagement strategy on energy that reconciles Europe's security and sustainability interests, while also navigating the balance between industrial development and open international trade. The updated strategy should encompass the following elements:

1. **A modern, forward-looking definition of energy security.** Moving away from a limited focus on supply security, the guiding principle of the revised strategy should centre on a comprehensive notion of resilience. This resilience should be defined as the low vulnerability of clean energy and industrial systems, anchored in three main pillars:
 - Domestic manufacturing: A certain amount of domestic industrial capacity can act as a safeguard against potential disruptions to cleantech supply chains;
 - Diversification: For those clean products that are "hard to repatriate", Europe should expand its supplier portfolio to reduce asymmetry in critical interdependencies.
 - Circularity: Emphasising recycling fosters a gradual decrease in dependence on imported goods and integrated supply chains.
2. **A consistent approach to Europe's external energy relations that reflects the EU's security and sustainability interests.** Europe should pivot its efforts to diversify the supply of both fossil and clean energy materials into an opportunity to enhance the sustainability of global supply chains. The reshuffling of international gas flows in the aftermath of Russia's invasion of Ukraine has positioned Europe as a pivotal market for numerous gas suppliers. This presents the EU with a transitional opportunity to leverage diversification efforts aimed at reducing methane emissions from key suppliers. Furthermore, Europe's plans to reclaim some clean technology production capacity will elevate its role as a major raw material importer. Europe should

leverage its market influence to advocate for cleaner mining practices worldwide. Collaborative initiatives, such as green buyers alliances, can foster sustainable resource extraction globally. These efforts should be integrated into an EU-level platform for joint purchasing of critical raw materials.

3. **A balance between industrial development and open international trade.** As Europe endeavours to repatriate segments of clean technology value chains, it must communicate its commitment to avoiding protectionist measures. Adopting a protectionist stance is both unfeasible, given the absence of certain inputs in Europe, and undesirable, as it would raise the costs of the energy and industrial transition while exacerbating geopolitical tensions. Instead, Europe should advocate for cooperative platforms that facilitate dialogue on various fronts, e.g. innovation, standard setting, as well as contentious issues such as production overcapacity. Furthermore, the establishment of green buyers alliances with other developed countries is essential. These alliances would provide consistent demand signals for clean basic materials, critical raw materials, clean energy, and components integral to strategic net-zero technologies.
4. **Articulate the opportunities arising from Europe's energy transition for our international partners.** Europe should address escalating North-South grievances by transforming the Green Deal into a mutually beneficial industrial opportunity. This entails promoting technology transfer in the cleantech sector and fostering the production and refining of critical raw materials in strategic partner countries. This can be achieved through financial derisking instruments linked with tools from the Global Gateway, developed within the framework of the Net-Zero Industry and Critical Raw Material partnerships. Additionally, the EU should open its domestic lead markets and support mechanisms for clean industrial goods to be imported from strategic partner nations. Furthermore, Europe should extend the model of the Just Energy Transition Partnerships to additional jurisdictions and aid countries with limited administrative resources in adapting to the CBAM.
5. **Set priorities concerning energy security and the clean energy transition in Europe's neighbourhood.** This involves providing clear guidance to fossil fuel partners regarding the EU's natural gas demand, integrating climate considerations into infrastructure planning, and granting flexibility

Elements adding to the resilience of industrial value chains

→ Fig. 20



Agora Energiewende and Agora Industry (2023): *Ensuring resilience in Europe's Energy Transition: The role of EU clean-tech manufacturing*

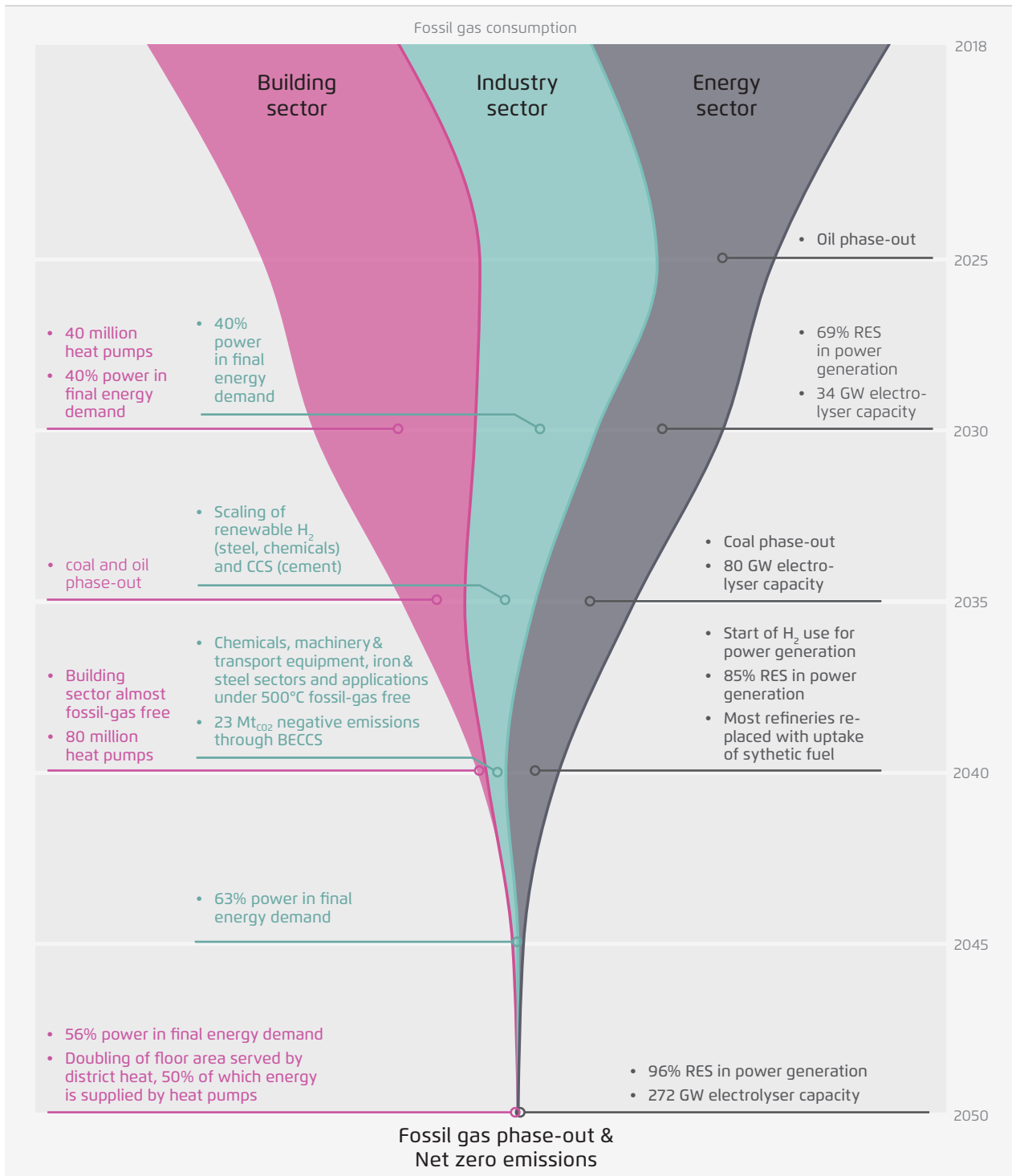
in long-term contracts. The EU should leverage its fossil fuel phase-down to gain a competitive advantage in decommissioning services and offer technical assistance to developing countries. Initiatives like the Just Energy Transition Partnerships should be established with coal consumers and producers in the Western Balkans, Moldova, Ukraine, and Turkey. Additionally, the EU should initiate bilateral efforts to protect critical infrastructures against external threats. Furthermore, the strategy should encompass an integrated vision for energy and industry, providing technical and regulatory support for decarbonisation, investing in local clean energy deployment, and assisting local authorities in adapting to carbon border adjustment mechanisms.

6. **Reflect Europe's cooperative, partnership-driven approach to addressing the climate crisis in its neighbourhood and worldwide.** The EU's domestic mechanisms and protocols designed to cope with the impacts of climate change, along with its preventive systems, should be expanded to include neighbouring regions. Additionally, this expansion should be accompanied by dedicated financial support to climate adaptation efforts in the broader neighbourhood.

Annex

EU Gas Exit Pathway: technological pathway towards fossil gas phase-out, EU-27

→ Fig. AX



Agora Energiewende (2023): *Breaking free from fossil gas. A new path to a climate-neutral Europe.*

References

Agora Energiewende (2024 forthcoming). *Next stop 2040: EU climate policy between economic opportunities and fiscal risks.*

Agora Energiewende (2023a): *Breaking free from fossil gas. A new path to a climate-neutral Europe.*

Agora Energiewende (2023b): *Ein neuer Ordnungsrahmen für Erdgasverteilnetze. Analysen und Handlungsoptionen für eine bezahlbare und klimazieltkompatible Transformation.*

Agora Industry, Fraunhofer Institute for Systems and Innovation Research ISI (2024, forthcoming). *Direct electrification of industrial process heat.*

Ember (2024), European Electricity Review: *Europe's electricity transition takes crucial strides forward.*

EPICO KlimaInnovation, Institut der deutschen Wirtschaft (IW) and Stiftung KlimaWirtschaft (2023): *Standortvorteil Erneuerbare Energien? Die Bedeutung der Verfügbarkeit von Erneuerbaren Energien als Standortfaktor in Deutschland.*

European Academies' Science Advisory Council (2022). *Forest bioenergy update: BECCS and its role in integrated assessment models.*

European Commission (2024a): *Communication. Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. COM/2024/63 final.*

European Commission (2024b): *Impact Assessment. Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. SWD/2024/63 final.*

European Commission (2023a): *Climate action Progress Report 2023.*

European Commission (2023b): *EU-wide assessment of the draft updated National Energy and Climate Plans. COM(2023) 796 final of 18.12.2023.*

European Commission (2023c): *Directorate-General for Energy, Bon-Mardion, J., Casteleyn, M., Queenan, J. et al., Study on energy subsidies and other government interventions in the European Union, Final report, 2023 edition.*

European Commission (2020b): *Impact Assessment. Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people. SWD(2020) 176 final.*

European Commission (2020b): *Energy prices and costs in Europe. COM/2020/951 final.*

European Environment Agency (2023a): *Economic losses from weather- and climate-related extremes in Europe.*

European Environment Agency (2023b): *Trends and Projections in Europe 2023. EEA Report 07/2023.*

European Scientific Advisory Board on Climate Change (2023): *Scientific advice for the determination of an EU wide 2040 climate target and a greenhouse gas budget for 2030 2050.*

Eurostat (2023): *Eurostat Statistics Explained. Environmental taxes in the EU.*

HLPE (2017): *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.*

IEA, IRENA & UN Climate Change High-Level Champions (2022): *Breakthrough Agenda Report 2022.*

Imperial College London (2022): *Biogas and biomethane supply chains leak twice as much methane as first thought.* ScienceDaily, 17 June 2022.

International Monetary Fund (2023): *Working paper: Cross-border risks of a global economy in mid-transition.*

OECD (2019): *The Heavy Burden of Obesity: The Economics of Prevention,* OECD Health Policy Studies.

Öko-Institut and Agora Energiewende (2020): *How to raise Europe's climate ambitions for 2030: Implementing a -55% target in EU policy architecture.*

Sanye Mengual, E. and Sala, S. (2023): *Consumption Footprint and Domestic Footprint: Assessing the environmental impacts of EU consumption and production.*

SolarPower Europe (2023): *Solar Heat Report - How Solar PV empowers households to turn down fossil gas and save on energy bills.*

World Health Organization (2022): *WHO European Regional Obesity Report 2022.*

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Agora Energiewende develops scientifically sound, politically feasible ways to ensure the success of the energy transition – in Germany, Europe and the rest of the world. The organisation works independently of economic and partisan interests. Its only commitment is to climate action.

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Proofreading: Karen Matzke

Typesetting: Urs Karcher

Title picture: Stump picture: Courtesy of Landesforsten.RLP.de / Idea: Lucas Landenberger / Data source: German Weather Service / Data processing: Rhineland-Palatinate Competence Center for Climate Change Impacts / Graphic design: igreen, Jonathan Fieber / Photo tree slice: Sebastian Kuchenbecker

323/02-I-2024/EN

Version 1.1, March 2024



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