

# Flagship Report: State of EU progress to climate neutrality

An indicator-based assessment across 13  
building blocks for a climate neutral future

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# Summary

## Assessing the state of progress to inform next steps in policy-making

The European Union (EU) is on its journey to become climate neutral by 2050. This multi-generational project holds many societal, economic, and environmental opportunities. At the same time, it is of unprecedented scale and implies considerable changes to the current systems, which need to be anticipated and addressed for the transition to be fair and acceptable to all. Regular progress checking is the key to understanding where the EU stands on the journey. It allows to identify challenges and opportunities and take targeted policy action guiding investment, supply, consumption, and societal development. There is still no official, comprehensive, and regular EU-wide progress monitoring to achieve this.

This second ECNO progress check aims to close the current information gap. It provides a comprehensive view on the state of EU progress towards climate neutrality and identifies key areas of action for the next policy cycle.

## The state of progress: notable advancements but still too slow

The EU has kept up its progress towards climate neutrality in many building blocks for a climate neutral society. Even though all 13 building blocks remain in the same progress classification as in the 2023 assessment, still requiring the transition to pick up pace, a closer look reveals important and promising progress in individual indicators and in new and revised policies. In this year's assessment, 75 indicators are moving in the right direction, and many small-scale shifts are bubbling under the surface. Ten indicators improved in their classification while three slowed down in their progress, changing to a lower classification:

**Industrial GHG emissions** decreased at a higher speed. This was also seen in **agriculture**. However, the pace of GHG reductions slowed in **electricity generation**. The **deployment of renewables** and **clean energy carriers** picked up speed. **Industrial energy** intensity also improved as did **public funds for environmental and energy R&D**.

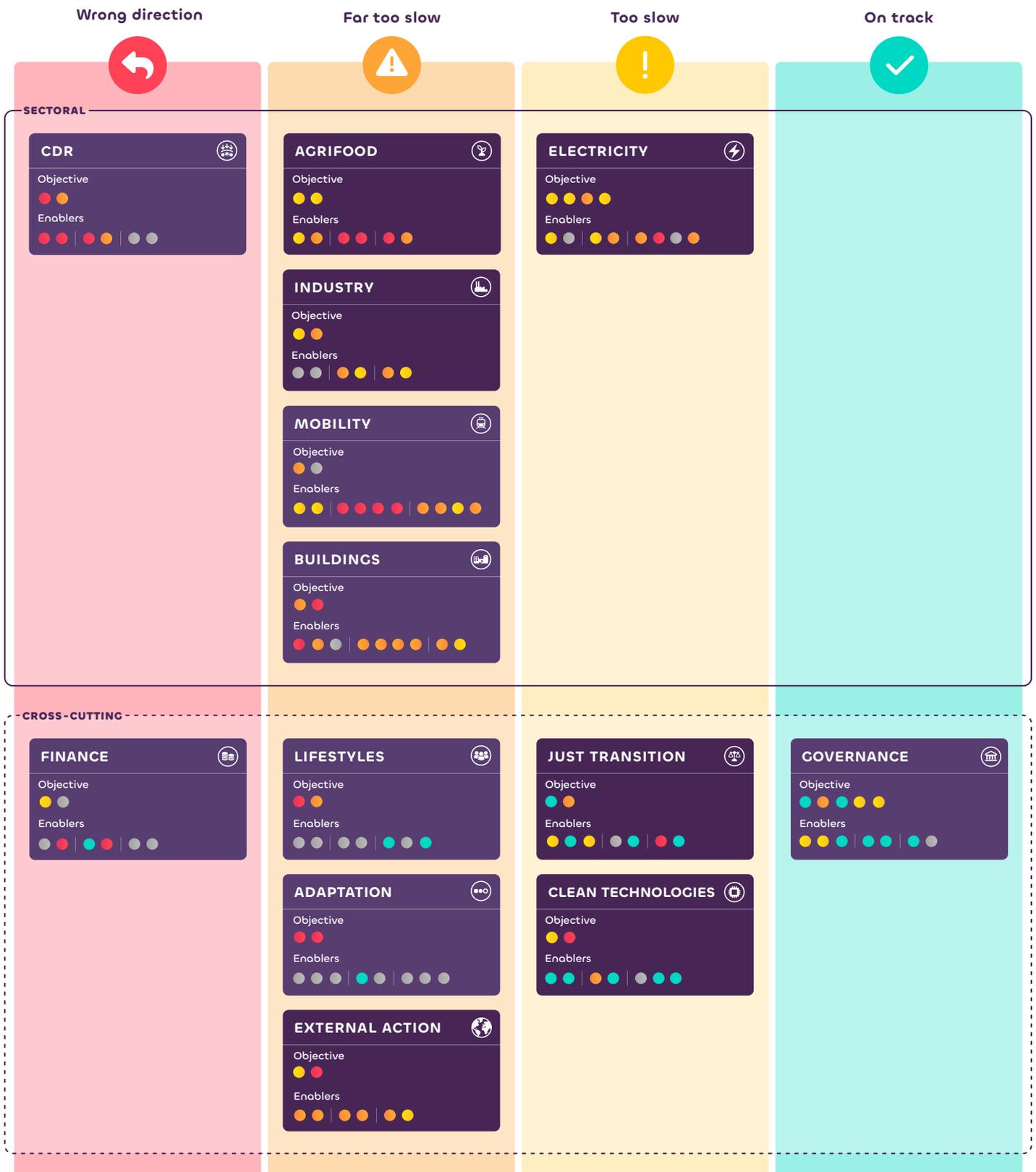
The transition to climate neutrality generated **more jobs in renewable energy supply chains and in environmental goods and services**. **Regional poverty** in coal and heavy industry regions declined, positively supported by an overall improvement in **employment** there.

However, the progress on reducing **material deprivation** slowed down due to the spike in fossil energy prices. There was an increase in **public support for households**, but it was disproportionately focused on short-term relief rather than long-term resilience. **Fossil fuel subsidies** tripled between 2021 and 2022, outpacing the growth in **support for energy efficiency purposes**, the share of which thus decreased.

Finally, there was an increase in the EU's **official development assistance (ODA) allocated to climate action** in 2021. This is an improvement, but the proportion of ODA allocated to climate action is still far too low.



Figure 1: State of progress across 13 building blocks of a climate neutral future



Note: Circles show the progress classification of this year and small circles the one from last year's progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ECNO (2024)

## Actions for 2024-2029 EU policy

### 1: Advance effective implementation of the existing policies

The broad set of EU policies adopted in the past four years now requires national implementation, thus it is identified as an action area in each building block. EU-level support to Member States, along with further specification of the legal requirements and stricter follow-up to ensure adherence would facilitate national implementation.

### 2: Get the finance right for the transition

A strong policy push is needed to redirect financial flows towards transition financing, including progressively phasing out fossil fuel subsidies, and to close the investment gap. Progress could be made by developing a new EU financing plan integrating existing regulations and funds to facilitate coordination and support for Member States.

### 3: Ensure a socially just and people-centred transition

Citizens show strong support for climate action. To maintain citizens' resolve, further progress is needed to ensure that they feel engaged in the process and that no one is left behind. A citizen-centric approach to decisions over the coming years could strengthen this dimension.

### 4: Accelerate the industrial transition as part of an EU competitiveness deal

Providing additional EU-level funding and leveraging existing spending may accelerate progress of the industrial transition. In addition, national energy and climate plans (NECPs) should consider the three enablers – circularity, energy efficiency, and zero carbon energy carriers.

### 5: Encourage efficiency, modal shift, and electrification in buildings and mobility

For buildings, the achievement of wide-spread deep renovation could be helped through compliance support and an enforcement system. In mobility, progress could be made by targeting corporate fleets, expanding cross-border public transport, and supporting Member States in their incentive schemes and infrastructure development.

**6: Ensure a predictable and just transition in agriculture**

Advancing progress in agrifood can build on a shift of public funding to encourage low-emission, socially just and resilient agriculture. Standardised criteria for food procurement and labelling would support healthier, plant-based diets. Action should be taken to reduce food waste.

**7: Invest in (natural) carbon dioxide removals urgently**

There is an urgent need to further expand sustainable forest practices and promote restoration, reforestation, and sustainable management – including a shift towards more near-natural forests. Deployment of technical CDR requires demonstrating its sustainability.

**8: Enhance global climate action through climate finance and diplomacy**

Global climate action could be advanced by the EU through effective partnerships and a foreign and trade policy centred around the global transition. International climate finance should correspond to the fair share and alignment of all public funds with the goals of the Paris Agreement.

**9: Improve data for smarter policy-making**

Action should be taken to close data gaps. These can include new or better reporting obligations and adjusted data collection routines that also improve the efficiency of processes and spending.

**10: Establish an official EU-wide transition monitoring**

The need for an official EU progress monitoring system persists. Integrating smartly with existing planning, monitoring, and reporting activities, such a system would allow for greater comparability, facilitate evaluations, and increase transparency. It could reduce overall effort and administrative burden for Member States and EU institutions alike.

# 1 Introduction

## 1.1 Progress monitoring as a tool for managing the EU's transition

### Enhancing European competitiveness by advancing the green transition

The European Union (EU) is on its journey to become the first climate neutral continent. Reaching climate neutrality by 2050 is legally enshrined in the EU Climate Law of 2021, with the goal of becoming net negative shortly thereafter. This multi-generational project holds economic opportunities and promises a better, more liveable environment. At the same time, the transition is of unprecedented scale and implies considerable changes to the current systems. Both beneficial and adverse impacts of these changes need to be anticipated and addressed for the transition to be fair and acceptable to all.

The journey to climate neutrality is a globally-shared endeavour, as agreed by all the Parties to the Paris Agreement. As laid out in the draft for the EU's Strategic Agenda, Europe's leadership in global climate action is crucial to uphold its competitiveness in an era increasingly defined by global green competition (EUCCO, 2024b). EU heads of state and governments have also realised this opportunity in calling for an EU competitiveness deal (EC, 2024e). Thus, a lack of further proactive policy focused on developing a competitive cleantech sector and greening EU industry risks losing market share and prolonging dependence on external producers of fossil fuel-based products and imported greener products and technologies alike. A successful transition can create a more resilient and self-reliant EU with its own green industrial base and a diversified cleantech trade.

## You cannot manage what you do not measure: tracking the transition

The EU has established a unique legal framework to measure and manage overall greenhouse gas (GHG) emissions with clear target setting. However, accomplishing the transition also requires coordinated action at both the EU level and in Member States to drive the necessary changes **under** the emissions curve. This includes changes across the EU, from a technology switch in industry, renovation of buildings, and sustainable forest management, to the incentive frameworks that governments put in place to support companies and citizens. To be effective, the related policy decisions should be informed by long-term pathways with distinct milestones for the many parallel and interlinked transformative changes needed. An effective monitoring system is the key to understanding where the EU stands on the journey along these pathways to a climate neutral future. It allows to identify challenges and opportunities and take targeted policy action guiding investment, supply, consumption, and societal development – while avoiding inadequate incentives that may lead to stranded assets or distributional conflicts.

Acknowledging this, Article 6.1 of the EU Climate Law requires a check of EU Member States' collective progress towards climate neutrality every five years. The European Commission (EC, 2023m) published the first of these assessments on 24 October 2023 as a section in its annual Climate Action Progress Report (CAPR) – itself a part of the eighth State of the Energy Union report. The EC's assessment of progress towards climate neutrality focussed almost entirely on GHG emissions data and offered no systematic look at the underlying structural changes in each sector that make the reductions possible (see ECNO, 2023). The EC acknowledged the shortcomings of this approach, stating that '(more) detailed monitoring is needed to assess progress on enabling factors that drive emissions (...) to better highlight areas where (...) more action is needed.' (EC, 2023m).

For now, the EC lacks a monitoring framework that can identify where there are bottlenecks or obstacles to the transition, as well as the promising trends that can be built on, so that targeted action can be taken to further the transition.



## Looking at enabling conditions: proof of concept has been provided

In June 2023, the European Climate Neutrality Observatory (ECNO) was launched with the publication of its first assessment of EU progress towards climate neutrality. The 2023 report (to which the one you are reading is an update) assessed progress in 13 sectoral and cross-cutting building blocks of a climate neutral future – using 104 indicators. The essential innovation: an unprecedentedly comprehensive picture of the pace of the transition across the economy, based on the state of progress of key enabling conditions, or ‘enablers’, in each of the building blocks. ECNO’s first assessment was able to demonstrate that – and how – net zero monitoring can be done and the added value it has over traditional ‘headline targets only’ approaches.

This picture of the state of EU climate policy progress was further complemented in January 2024, when the European Scientific Advisory Board on Climate Change (ESABCC) published its analysis of ‘progress, policy gaps and opportunities’ with regard to the EU climate neutrality goal. The Board also based its assessment on an indicator framework designed to check for enabling conditions, citing ECNO as an inspiration (ESABCC, 2024). This underlines the added value of adequately detailed monitoring for the formulation of concrete policy recommendations.

## ECNO in 2024: inputs for the EU policy work programme 2024-2029

This second ECNO progress check comes at a political juncture for EU policy, with a newly elected European Parliament (EP) and soon a new Commission. The new strategic agenda is informed in part by the economic effects of the crises of the past cycle (in particular, the Russian war on Ukraine and the resulting energy price hike). EU policy is also being shaped in response to the actions taken by other geopolitical players, such as the United States’ Inflation Reduction Act (IRA), which sparked a remarkable surge in investments for a fossil-free US economy (Mackintosh, 2024; The White House, 2023).

Over the past five years, the European Green Deal (EUGD) has been the overarching strategy for EU policy, with the goal of climate neutrality as a guiding star. It has produced a significant advancement of EU legislation (such as in the Fit for 55 package), revising and expanding existing instruments to speed up the transition. This has been done with a view to addressing multiple objectives in an integrated strategy: reducing dependence on external energy imports, strengthening EU manufacturing capacity, and anticipating social dimension of change.

Climate action is and must remain at the heart of Europe’s economic and security policy: it is needed for keeping Europe competitive, sovereign, independent – and, of course, sustainable. Decision-makers need to build on the actions already taken within the EUGD in the next EU cycle of 2024-2029. It is crucial to know where and why progress is slow, so that policy-makers can take the necessary action to unlock and facilitate the desired changes efficiently and effectively. This report is intended to provide an important input to their work.

## 1.2 Objective and approach of this report

This report aims to provide a comprehensive view of EU progress towards climate neutrality across the economy. Progress is measured against the EU's vision for a climate-neutral future, which is based on the targets and benchmarks outlined in official EU documents. As the ECNO approach focuses on the underlying enablers of change, the analysis can show if the necessary structural changes are occurring at a sufficient pace therewith providing an early indication of the adequacy of ongoing developments that will drive future emission reductions. This analytical framework offers an unparalleled perspective on the EU's current standing and prospects ([see 6 for more detail](#)).

### A deeper look at what is driving the transition in the EU

ECNO has **expanded and deepened its perspective** over the first assessment in two ways:

1. Following an internal review of the previous framework and based on feedback collected from experts, the assessment now includes 20 more indicators (from 104 to 124). The refinement underlines the findings but allows for further nuance and differentiation.
2. Moreover, a deeper analysis was undertaken for four of the 'enablers', probing into national-level data to understand Member States' progress and policies and to see how these shape EU-level trends.

The results presented in this report include a **comparison to last year's assessment**. Wherever new information was available, data has been updated to include the most recent year. This means that this progress check is largely based on the rates of change over the period **2016 to 2022**, while it was largely 2015 to 2021 in last year's report ([for details for methodology see 6](#)).

## Complementing the latest data with recent policy action

This year's report has paid specific attention to the policy context to, at least partially, compensate for the time lag until the impact of recent policy changes is reflected in the data. This gives more accurate insights into the state of EU progress as it complements latest data with up-to-date information on policy progress.

The time lag has two main reasons: 1) EU policies take time to be implemented (e.g., at the national level); and 2) policies need time to unfold their full impact (e.g., in terms of market response or change in investments). In addition, institutions need time to collect and publish data. The latest data thus show measurable changes over time but generally stop in 2022, with some exceptions where indicator data already include 2023. Therefore, the indicator trends cannot yet show the impact of recent policy changes, of which there have been a significant number over the past two to three years.

Therefore, each building block section now provides a dedicated exploration of policies proposed, decided, or implemented. Significant policy action may speed up developments in areas where progress has been too slow, even if this is not yet visible in the data. This 'promise of future change in the data' (even if it may be a few years in the making) has been included in this report in a more systematic and structured manner than in 2023. Considering the difficulties in assessing the likely future impact of individual policies on specific indicators, this policy context dimension acts as important complementary information but has not been quantified.

## Outline of this report

The insights are presented as follows: This introductory [section 1](#) is followed by the results of this year's analysis of all 13 building blocks and by overarching themes in [section 2](#). [Section 3](#) reflects upon the key insights and policy implications, providing concrete recommendations for attention in the next policy cycle. For those with interest in further specifics, [section 4](#) provides the detailed assessments of all building blocks presenting the data and outcomes for each of the objectives, enablers, and their indicators. A new feature of this year's report are four deep dives zooming in on crucial enablers of the transition, also looking at the state of progress and related policy actions in Member States, presented in [section 5](#). Lastly, [section 6](#) recaps on the ECNO methodology and provides an overview of indicator changes compared to last year's report.



# 2 EU progress towards climate neutrality

This section presents the **top line insights of the analysis**. It starts with an overview of progress for all building blocks (2.1), the main changes on the indicator level (2.2), policy context (2.3), and progress on specific cross-cutting drivers of the transition (2.4), whereby [Excursion 1](#) and [Excursion 2](#) provide additional information on the deep dives and data gaps. The findings build on 124 indicators which collectively reflect important objectives and enablers of change across 13 building blocks of a climate neutral society (see 4). The progress check is based on the rate of past change compared to what is required to meet climate neutrality considering EU targets and modelling (see 6 for methodology details).

## 2.1 Still too slow overall

### Promising progress in individual indicators

ECNO's 2024 **assessment shows notable progress** in the transition to climate neutrality in many building blocks, for instance, in electricity, just transition, and industry. Many promising European Green Deal policies give hope for further improvement in the coming years. Even though all 13 building blocks for a climate neutral society remained in the same classification as in the last year's report (see [Figure 1](#)), this does not signal a standstill. A closer look at the building blocks reveals important and promising progress in many individual indicators (see 2.2). Furthermore, the analysis of the policy context points to where indicator ratings are likely to improve in the future (see 2.3). A short summary of each building block is provided in [Table 1](#).

Still, while the transition to climate neutrality is on its way, it **needs to pick up speed** to reach the target by 2050 at the latest. The need for further policy action also persists across all building blocks – some needing to speed up progress and others needing to maintain the pace of progress over the next years. Additional action is most urgent in finance and carbon dioxide removals, where a U-turn is required to start moving in the right direction.

## Most building blocks move in the right direction

EU climate **governance** remains **on track**, as shown by high-level management frameworks and institutions being put in place at national and EU levels. However, the implementation of these frameworks is lacking in many areas at the national level, especially regarding follow-through with EU requirements under the Governance Regulation.

On the brink of being assessed as **on track** are **clean technologies** and **electricity**. The needed changes here are being set in motion, but for the moment still somewhat **too slow**. In addition, **just transition** was progressing at a **too slow** pace, with small yet important improvements in individual areas particularly on reducing poverty in coal and heavy-industry regions and on creating job opportunities.

Progress was still **far too slow**, and therefore significantly below the pace needed for climate neutrality by 2050, in the sectors **agrifood, buildings, industry, mobility**, as well as **lifestyles**. Progress was also still **far too slow** for the EU's **external action**. Moreover, the EU remains poorly equipped with regards to **adaptation** to climate change.

For **lifestyles** and **external action**, the data is thin, leaving much of the overall assessment to available qualitative information.

## U-turn needed on finance and carbon dioxide removals

Perhaps most alarmingly, in comparison to the 2023 assessment, there was only little advancement and even some deteriorations in **finance**, as public funds for fossil fuels increased while the share of environmental tax revenues declined. In **carbon dioxide removal**, natural sinks and related forest growth kept decreasing, although at a lesser speed compared to last year's assessment. Thus, these two building blocks keep moving in the **wrong direction**.



Figure 2: State of progress across 13 building blocks of a climate neutral future



Note: Circles show the progress classification of each of the indicators with same color-coding as used for the building block classification. See Table 35 for further information.

Source: ECNO (2024)

Table 1: Headline results across 13 building blocks

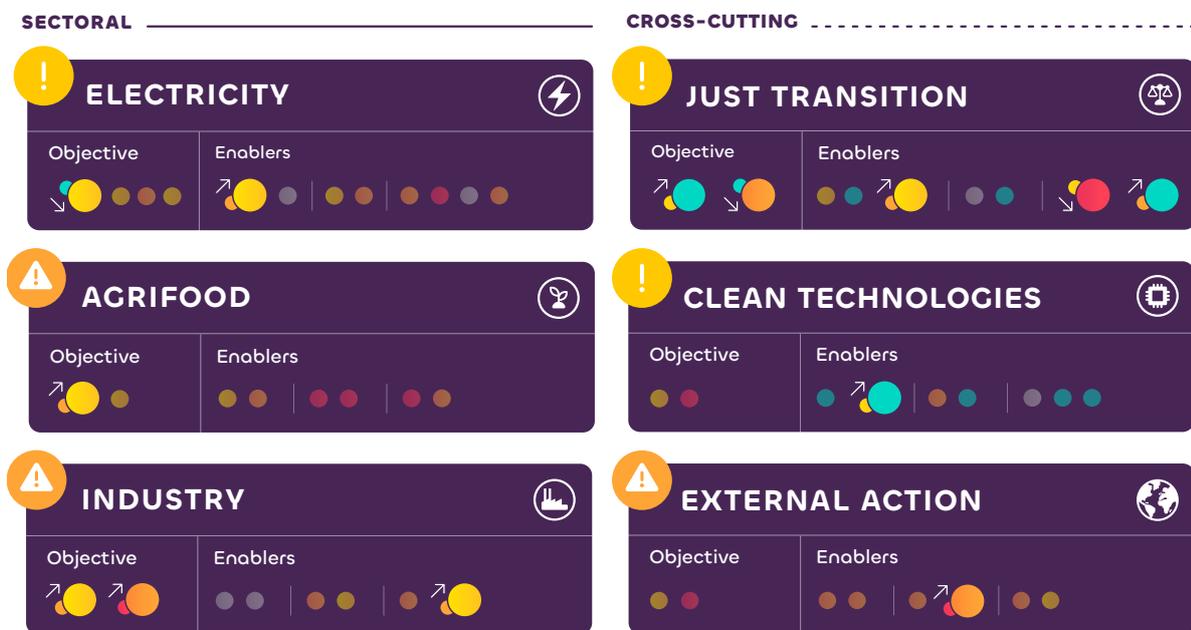
SECTORAL BUILDING BLOCKS	
 <b>Electricity</b>	The growing share of solar and wind and the increasing move away from gas for power and flexibility provision, along with policy boosts from the Fit for 55 package and REPowerEU, provide a positive outlook.
 <b>Mobility</b>	There has been a significant policy push towards cleaner vehicles, but more action is needed to shift away from road transport and to manage overall motorised transport demand.
 <b>Industry</b>	Noteworthy progress on overall GHG emissions and clean energy use, but enablers like circularity and energy intensity lag. New policies such as the Net Zero Industry Act (NZIA) promise future improvements.
 <b>Buildings</b>	There are no sign of improvements in the latest data and there has been only limited policy action since. Particularly building renovation needs to progress faster, using national incentive schemes.
 <b>Agrifood</b>	Emissions have decreased; however, progress among key enablers, including diet shifts, manure management, and food waste, remains far too slow to unlock the next level of reductions.
 <b>Carbon Dioxide Removal</b>	Natural sinks keep decreasing; technical sinks remain mostly in demonstration phase. There has been some policy progress in monitoring and certifying carbon removals, as well as ecosystem restoration.
CROSS-CUTTING BUILDING BLOCKS	
 <b>Lifestyles</b>	There is some progress in habits and awareness, and a few promising policy proposals to establish the right choice architecture, but data are scarce, and the carbon and material footprints remain far off.
 <b>Clean Technologies</b>	Progress is evident in public R&I spending and the EU's policy architecture, following the Industrial Plan. However, private R&I investments remain too low, hindering the long-term competitiveness of the sector.
 <b>Finance</b>	It is moving in the wrong direction with half of the annual investment needed missing and an increase in fossil fuel subsidies partly due to crisis response risking the transition overall.
 <b>Just and Inclusive Transition</b>	Clear progress despite the onset of the energy crisis; evidence-based Social Climate Plans and effective implementation of Territorial Just Transition Plans are needed to ensure further support, investments, and reskilling.
 <b>Governance</b>	The expanded set of indicators reaffirms that EU governance is moving in the right speed, but new indicators on national level implementation point to crucial weaknesses.
 <b>Adaptation</b>	National policies offer hope, but there is no improvement yet in the resilience of countries, and losses from climate events keep increasing. There is a notable lack of data for a grounded assessment.
 <b>External Action</b>	Although there has been small progress with improved finance, the EU is moving far too slowly in its role of leading global climate action and needs to accelerate its efforts.

## 2.2 Individual indicators show progress in important areas

The data shows that the transition is on its way – with 75 indicators moving in the right direction, and many small-scale shifts simmering under the surface. In many cases, the transition still needs to accelerate, which explains why the overall classifications of the building blocks have not changed from last year. However, in the case of ten individual indicators, the changes were so significant that they resulted in an improved classification.

At the same time, three indicators slowed down in their progress leading to a lower classification (see Figure 3). 22 indicators still moved in the **wrong direction**, with four of them being in mobility and CDR each.

Figure 3: Progress under the emissions curve: changes in assessment of individual indicators



Note: Large circles show the progress classification of this year and small circles the one from last year's progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ECNO (2024)



## Data show importance of improving enabling conditions

Where sectoral GHG emissions have changed so that classifications were updated, it was partly the indicators on their underlying enablers that drove that change. This demonstrates the relationship between the larger objectives and their enabling conditions:

In **industry**, overall GHG emission reductions nearly doubled in pace compared to last year's assessment; thus moving up from **far too slow** to **too slow**. This follows an increase in the use of clean energy carriers – this indicator has reversed course, now heading in the right direction compared to last year's assessment when it saw a decline; the energy intensity of output also decreased at a higher speed. Importantly, these changes came before the significant decline of output in energy-intensive industries in 2023, as the assessment only covers data up to 2022.

The annual public funds for environmental and energy R&D to enable further **cleantech** development slightly increased compared to last year's assessment and is now moving at a sufficient pace following some stagnation in 2021.

GHG emission reductions in **electricity** generation saw a slowdown in this year's assessment, leading to a change in classification from **on track** to **too slow**. This is most likely the result of the trendline flattening following the pandemic, showing particularly low GHG emissions. In contrast, the share of variable renewable electricity generation picked up in speed compared to last year's assessment from being **far too slow** to only **too slow** following cost reductions in solar PV and favourable policy frameworks for renewable energies.

The **agricultural** GHG emission reductions nearly doubled – albeit still at a very slow pace – compared to last year's assessment being henceforth only **too slow** instead of **far too slow**. The steeper reduction in emissions can mainly be attributed to a reduction in fertiliser use, which was largely caused by the energy crisis. All other indicators saw only slight improvements or lacked data updates to re-assess progress.

A lot of movement was visible in the indicators looking at a **just and inclusive transition**. Regional poverty plummeted reaching a speed that is **on track** to reach the 2030 target between 2017 and 2022. At the same time, reductions in the material deprivation across the EU slowed down. The apparent discrepancy results from the cost-of-living crisis in 2022, during which high fossil energy prices impacted particularly the latter indicator. Emergency protection policies, which drove the increase in public support for households as well as earlier advancements in the transition to renewable energies, mitigated the rising energy prices to some extent; however, as a consequence, fossil fuel subsidies grew significantly, outpacing the support for energy efficiency purposes, the share of which thus decreased. Clearly visible in the data, the transition to climate neutrality generates more jobs in renewable energy supply chains and in environmental goods and services, which also supports employment rates in affected regions.

And finally, in **external action**, the official development assistance (ODA) of the EU allocated to climate action improved its classification: in last year's report (covering the period from 2016 to 2020), it was developing in the **wrong direction**, while in this year's report (covering the period from 2016 to 2021), it was moving in the right direction, although at a far **too slow** pace. This follows a significant increase in ODA allocated to climate action in 2021, which is positively emphasised here.

Table 2: Progress assessment across all indicators

✓ On track
! Too slow
⚠ Far too slow
↶ Wrong direction
❓ Insufficient data
2023 — 2024

Electricity	Mobility
<ul style="list-style-type: none"> <li>GHG emissions of electricity generation</li> <li>Share of fossil fuel-fired power generation</li> <li>Share of gas fired power generation</li> <li>Share of coal-fired power generation</li> <li>E1 Share of variable renewable electricity</li> <li>E1 Electricity interconnector capacity for cross-zonal trading</li> <li>E2 Investment into power grid</li> <li>E2 Share of electric smart meters</li> <li>E3 Battery storage capacity</li> <li>E3 Non-fossil participation in capacity markets</li> <li>E3 Flexible power demand</li> <li>E3 Share of electricity in final energy demand</li> </ul>	<ul style="list-style-type: none"> <li>GHG emissions from transport</li> <li>Carbon intensity of passenger transport</li> <li>E1 Total passenger transport volume</li> <li>E1 Total freight transport volume</li> <li>E2 Share of passenger transport volume on road</li> <li>E2 Share of passenger transport volume on rail</li> <li>E2 Share of freight transport volume on road</li> <li>E2 Share of freight transport volume on rail</li> <li>E3 Share of EVs in passenger car stock</li> <li>E3 Share of ZEVs in heavy-duty vehicle stock</li> <li>E3 Share of ZEVs in new passenger car registrations</li> <li>E3 Total number of recharging points</li> </ul>
Industry	Buildings
<ul style="list-style-type: none"> <li>GHG emissions from industry</li> <li>Share of clean energy carriers in energy and feedstock use</li> <li>E1 Annual production of renewable hydrogen for industrial use</li> <li>E1 Amount of CO<sub>2</sub> captured</li> <li>E2 Circular material use rate</li> <li>E2 Resource productivity</li> <li>E3 Final energy consumed in industry</li> <li>E3 Energy intensity of output</li> </ul>	<ul style="list-style-type: none"> <li>GHG emissions from buildings</li> <li>Demand of cement or concrete blocks and bricks</li> <li>E1 Average space per capita</li> <li>E1 Demand for heating of residential buildings</li> <li>E1 Demand for heating and cooling</li> <li>E2 Investments for energy renovation</li> <li>E2 Average renovation rate</li> <li>E2 Deep renovation rate of residential buildings</li> <li>E2 Deep renovation rate of non-residential buildings</li> <li>E3 Share of renewable energy in heating and cooling</li> <li>E3 Heat pump sales</li> </ul>

### Agrifood



<b>O</b>	Agricultural emissions	
<b>O</b>	Cattle meat consumption	
<b>E1</b>	Nitrogen fertiliser use	
<b>E1</b>	Share of organic farming in total agricultural area	
<b>E2</b>	Livestock numbers	
<b>E2</b>	Manure management emissions intensity of cattle	
<b>E3</b>	Volume of food waste	
<b>E3</b>	Emissions from food processing, transport, and packaging	

### Lifestyles



<b>O</b>	Per-person material footprint	
<b>O</b>	Per-person carbon footprint from household expenditure	
<b>E1</b>	Investment in cycling infrastructure	
<b>E1</b>	Population living in municipalities that promote sustainable food in canteens	
<b>E2</b>	Price on carbon	
<b>E2</b>	Affordability of vegetarian compared to meat options	
<b>E3</b>	Self-reported climate-conscious behaviour	
<b>E3</b>	Climate-damaging advertisement	
<b>E3</b>	Sales trends of plant-based food items in EU	

### Carbon Dioxide Removal



<b>O</b>	Net removals from LULUCF	
<b>O</b>	Net removals from technical solutions	
<b>E1</b>	Growth in forest area	
<b>E1</b>	Growth of carbon stock in forest land	
<b>E2</b>	Concentration of organic carbon in arable land	
<b>E2</b>	Net CO <sub>2</sub> emissions from croplands, grasslands and wetlands	
<b>E3</b>	Attention to technical CDR	
<b>E3</b>	Costs of BECCS and DACCS	

### Clean Technologies



<b>O</b>	Clean technology industry added value	
<b>O</b>	Index of eco-innovation related patents	
<b>E1</b>	Index of eco-innovation related publications	
<b>E1</b>	Public funds for environmental and energy R&D	
<b>E2</b>	Private energy R&I spending	
<b>E2</b>	Early-stage private cleantech investment	
<b>E3</b>	Share of green public procurement	
<b>E3</b>	Cleantech scale-up finance	
<b>E3</b>	Battery manufacturing capacity	

### Finance



<b>O</b>	Climate investment gap	
<b>O</b>	Climate-hostile financial flows	
<b>E1</b>	Public climate subsidies	
<b>E1</b>	Fossil fuel subsidies	
<b>E2</b>	Share of GHG emissions covered by a carbon market price or tax	
<b>E2</b>	Revenues from environmental taxation	
<b>E3</b>	Share of banks with a sound transition plan	
<b>E3</b>	Share of new banking loans aligned with the Paris agreement	

### Just and Inclusive Transition



O	Regional poverty rate	↗ ✓
O	Average of four relevant sub-indicators in the material deprivation rate	↘ ⚠
E1	Employment in environmental goods and services	⚠
E1	Employment rate in regions	✓
E1	Employment in renewable energy supply-chains	↗ ⚠
E2	JTF progress implementation	?
E2	Share of accepted Territorial Just Transition Plans	✓
E3	Share of support for energy efficiency purposes	↘ ↻
E3	Share of support for households	↗ ✓

### Adaptation



O	ND-GAIN country index	↻
O	Economic losses from climate-related extremes	↻
E1	Green urban areas	?
E1	Share of gentle tillage practices	↘ ?
E1	River restoration	?
E2	National adaptation policies	✓
E2	Monitoring, reporting, evaluation in place or being developed	?
E3	Total investment needs	?
E3	Total planned expenditure	?
E3	Actual spending	?

### Governance



O	Adoption of climate framework laws at national level	✓
O	Thorough implementation of EU governance requirements at national level	⚠
O	Public support for and confidence in the transition to climate neutrality	✓
O	EU cities committed under the Covenant of Mayors	!
O	Science-based climate neutrality targets in large EU companies	!
E1	Up-to-date and compliant long-term strategies (LTS) at national level	⚠
E1	National progress monitoring that can trigger additional action	⚠
E1	Independent scientific advisory bodies at national level	✓
E2	Green budgeting practices at national level	✓
E2	Up-to-date strategic climate planning at EU level	✓
E3	Citizens' climate assemblies at national level	✓
E3	Quality of consultations on EU climate policy impact assessments	?

### External Action



O	International climate finance	⚠
O	Imported CO <sub>2</sub> emissions	↻
E1	Public finance for international fossil fuels projects (by EIB)	⚠
E1	Public finance for international clean projects (by EIB)	⚠
E2	Paris Agreement references in trade agreements	⚠
E2	ODA allocated to climate action	↗ ⚠
E3	Climate-relevant expertise	⚠
E3	Prioritisation of climate diplomacy	⚠

Note: O: objective; E: enabler. 28 indicators are new to the indicator set and cannot be compared to last year's assessment. For 13 indicators no data update was available so that their classification remains the same.

Source: ECNO (2024)

## 2.3 Beyond data points: policy context

In addition to looking at indicators, this report evaluated the policy context of each building block to create a bridge between the quantitative assessment based on historical data and a sense of likely developments in the near future, in which recent policy decisions may advance the transition further – or not. The EU legislative cycle of 2019 to 2024 saw a whole range of relevant policies proposed and adopted as part of the European Green Deal (EUGD) that can be expected to positively impact the sectoral and cross-sectoral transition.

### Fit for 55 moves the needle on the transition speedometer

Raising the 2030 climate target to 55% net GHG emission reductions in 2022 led to a range of additional policy initiatives under the EUGD, known as the Fit for 55 policy package.

The **Fit for 55** legislative package is expected to drive significant improvements on GHG emission reductions upon progressive implementation across Member States. The measures send a robust, long-term signal that the transition to a just and inclusive net zero economy is underway.

One key measure is the revision of the **EU Emissions Trading System** (EU ETS), which now sees its emission trajectory going to zero by close to 2040. The progressive phasing out of free emission allowance allocation to industry is coupled with the introduction of the **Carbon Border Adjustment Mechanism** (CBAM), which is meant to level the playing field for EU industries vis-à-vis non-EU competitors that do not face the same carbon pricing. These changes pave the way for long-term changes in the electricity and industry building blocks while fostering improved financial flows to back the transition in other areas.

The introduction of a **second European Emission Trading System** (EU ETS2) will extend the reach of carbon pricing to emissions from fuel combustion in road transport and buildings as well as small industrial facilities not covered under the EU ETS. For the former two sectors the data currently show a clear lack of progress. The ETS2 will become fully operational in 2027, so its impacts will take time to show.

The **Energy Performance of Buildings Directive** (EPBD) defines the zero-emission standard for new buildings, sets improved Minimum Energy Performance Standards for non-residential buildings and puts more focus on renovating worst-performing residential buildings. It also includes provisions to simplify the energy renovation process. In mobility, the introduction of stricter **Emission Performance Standards** (EPS) for new vehicles will usher in a new era in the automotive industry. The adoption of low and zero-emission vehicles is expected to accelerate; an indicator that is still classified as **too slow** as per the latest data available. Complementing, the EU reinforced the **Alternative Fuels Infrastructure Regulation** (AFIR) to better coordinate recharging infrastructure development. The transition to electric mobility is clearly underway with this policy.

The impacts of carbon pricing on consumers are increasingly considered in the Fit for 55 policy changes. A **Social Climate Fund** (SCF) was established to support vulnerable households and small enterprises impacted by the transition, supporting a just and equitable process. Complementing this effort, the **Just Transition Mechanism** (JTM) already starts to assist regions and communities reliant on carbon-intensive activities.

Energy efficiency and renewable energies, both crucial enablers in most of the sectoral building blocks, saw target improvements as a follow-up of the raise of the overall 2030 climate target. The revised **Energy Efficiency Directive** (EED) sets a mandatory EU-wide target of an additional 11.7% reduction in final energy consumption by 2030, implements the efficiency-first principle along the energy supply chain, and requires Member States to save energy in all sectoral building blocks. The **Renewable Energy Directive** (RED III) sets an EU-wide target of achieving at least 42.5% and aiming for 45% of renewables in energy consumption by 2030. This and other obligations will push forward the expansion of renewable energies into all energy-consuming building blocks while also somewhat strengthening sustainability criteria for forest biomass, which may have some positive impact on forest carbon stocks.

Finally, the **Land Use, Land Use Change and Forestry Regulation** (LULUCF Regulation) sets EU- and Member State-specific natural carbon dioxide removal targets and provides accounting rules. Until 2026, it requires Member States to compensate emissions from land use with at least an equivalent quantity of removals; after that, it enforces binding EU and national net removal targets. The implementation of measures to stabilise and improve natural removal is the responsibility of Member States – with limited net impact so far as shown by the still declining natural removals.

Overall, the comprehensive, combined Fit for 55 policy package, if implemented thoroughly, will likely increase the pace of the transition towards a just and inclusive climate neutral society. As such, the picture presented in [Table 2](#) is likely to change in the coming years.

## Crisis response through EU policies advanced the transition - largely

The response to the Covid-19 pandemic in 2020/2021 brought additional investment into climate-related projects via the **Recovery and Resilience Facility** (RRF). The instrument launched under NextGenerationEU provides grants and loans for Member States to overcome the Covid-pandemic and to get more sustainable and resilient: Each Member State must allocate at least 37% of these funds to climate action. So far, the estimated average lies at 42% thus exceeding the target (EC, 2024h).

The energy crisis of 2022/2023, brought on by the Russian invasion of Ukraine, led to a push for energy savings and faster build-out of renewable energy under the **REPowerEU** initiative launched in May 2022. Higher EU 2030 targets were agreed for both areas as part of the revision of the EED and RED as well as accelerated permitting rules for renewables. The RRF finances Member State projects to save energy and shift to renewable energies. However, in face of the imminent crisis, additional investments in alternative gas infrastructure were also made, as part of a wider strategy to reduce reliance on Russian gas.

Lastly, the EU was challenged by international actors to up the game in its mission to become a climate neutral powerhouse. While China started to dominate the transition supply chains (see e.g., IEA 2024e), in summer 2022, the United States Congress adopted the **Inflation Reduction Act** (IRA). The IRA provides significant investment support for renewable energy and related climate-friendly projects and products, including a quota for manufacturing of relevant goods inside the USA. In the EU, a response was formulated to strengthen European manufacturing in the **Green Deal Industrial Plan**, which is a first step in the right direction. The **Net-Zero Industry Act** (NZIA), proposed in March 2023 and adopted in early 2024, sets production targets for European production of strategic technologies and introduces sustainability and resilience criteria to public procurement calls and renewables auctions. The **Critical Raw Materials Act** (CRMA) aims at increasing the capacities at each stage of the critical raw materials value chain, while also diversifying its import sources. Both acts provide a policy signal to investors that the EU is moving forward in ensuring a resilient supply chain for its cleantech ecosystem.

## Policy mapping identifies blind spots: homework for the next EU cycle

An in-depth look at policies for each building block also identified areas where limited policy progress was found, and thus, where additional action is required. This includes most prominently agrifood and in the management of motorised transport demand:

In the **agrifood** sector, new policy interventions have been minimal since the adoption of the **Farm to Fork Strategy** in 2020. Although the revised **Common Agricultural Policy** (CAP) intends to direct 40% of its budget towards providing ‘climate-relevant’ support, the EU decided on loosening key environmental regulations under CAP rendering serious emission reductions even more unlikely. Looking ahead, the CAP could be revitalised to serve as a tool for promoting sustainable agricultural practices.

Hardly any policy action is visible in the management of motorised transport demand, a key enabler in the **mobility** building block. For now, it is not recognised as a policy option in the **Sustainable and Smart Mobility Strategy**. On a positive note, the **Declaration on Cycling**, adopted in April 2024 and the **Trans-European Transport Network’s** (TEN-T) call for **Smart Urban Mobility Plans** may be first steps in the right direction.

## 2.4 Key trends in cross-cutting drivers of the transition

The mix of sectoral and cross-sectoral building blocks in the ECNO methodology allows for a broad understanding of the transition within and across sectors. However, the transition is a complex whole-economy project, where change in one building block often also impacts the pace or even feasibility of change in others. Hence, in some cases, progress can only really be assessed when combining two or more of the building blocks, enablers, or individual indicators. In this year's assessment, the focus in doing so is on greening industry, electrification, investment, and citizen's needs.

### The greening of industry is gradually starting

A cornerstone of the EU economy is its industrial base. The production of goods in the EU ensures jobs and value added, it increases the resilience of the EU, and safeguards its political independence. In the context of global competition in an era of climate action, the transition to a climate-friendly industry becomes an advantage. Enablers of the industrial transition are a smooth and swift shift to sustainable production, including a switch to renewable energies, increased energy efficiency, and circularity. The sector should also have sufficient capacities to produce the products and technologies required today and tomorrow for the transition. On both fronts, the 2024 assessment finds noteworthy improvements, with industrial GHG emission reductions picking up in speed. Cleantech was also moving forward, even being on the verge of achieving the classification **on track**.

As a prerequisite for greening the industry, encouragingly, the R&I architecture remains vibrant. Investments in start-ups were growing at the right pace as did public funds allocated to environmental and energy R&D and private scale-up finance for clean technologies. The completion of just transition plans under the JTM and first disbursements enable new activities in transition regions. Alongside this, employment such as in the renewable energy supply chains also increased in speed. However, private scale-up finance saw signs of plateauing in recent years, and private spending on R&I remains too modest. The use of clean energy carriers, resource productivity, and the reduction of final energy consumption (even before the energy crisis led to the decline in industrial activity in 2023) all increased in speed but remained **far too slow** to align with the path to climate neutrality. Particularly, progress should be made in the circular material use rate, which saw no improvement compared to last year's assessment. The overall need to further accelerate the investment into clean technologies – in industry but also all other sectors – becomes visible when comparing the investment with what is estimated to be required: the climate investment gap amounted to EUR 406 billion in 2022. This translates to 50% of investment missing for the transition.

The EU ETS as the key climate policy has set a clear timeline for industrial emissions. The transition of industry and the shift to more efficient and clean products has received particular policy attention with the EU's Green Deal Industrial Plan and the following CRMA and NZIA. While the CRMA aims at securing sustainable raw material supply through increasing EU's capacities in extraction, processing, and recycling, the NZIA includes provisions for public procurement and might crowd in more private finance, as might the wind power guarantee as part of the wind power package. In addition, the proposed Ecodesign Regulation aims at making products more sustainable, ensuring the same criteria for all products that enter the EU market. The Corporate Sustainability Due Diligence Directive (CSRD), and the revision of the Capital Requirement Directive (CRD) could steer more private investment towards the transition.

### **Electrification across the economy needs advancing**

Electrification is one key option to reduce GHG emissions in the energy-consuming sectors if it is combined with clean power supply and efficient energy use. Promisingly, the shift to clean sources in electricity generation was increasing and may start progressing at the right speed soon. This is partly because Europe saw high fossil energy prices that drove the build-out of renewables. The EU has also put forward supportive policy frameworks that incentivise the shift to renewable energies and enabling conditions, but they still need to be implemented in the Member States. At the same time the reform of the EU ETS has intensified the price pressure on fossil fuel-based generation. The implementation and follow-through in form of scaled up investments into clean power generation, flexibility options, and power grids are key to success.

Between 2017 and 2022, electrification overall remained almost stable. There was some advancement with new technologies entering the market. However, their uptake remained below the required pace of change, and their impact on the share of electricity in final energy consumption continued to be limited in the period assessed: in mobility, the share of EVs in the vehicle stock is only slowly increasing and even new registrations of passenger EVs remain too low. The number of charging points increased quite substantially but remains insufficient. This is similar in buildings, where heat pump sales have picked up in speed but remain behind the required change. In industry, electricity consumption remained relatively stable.

The EU adopted, and currently adopts, policies that will help electrification, particularly in transport and buildings. The revised CO<sub>2</sub> performance standards for cars and vans will phase out those using fossil fuels by 2035 and is globally the most ambitious standard – together with the UK's standard (ICCT, 2024); those for trucks will further reduce their emissions and are close to adoption at the time of writing. The proposed Ecodesign Regulation stipulates the cessation of the sale of fossil fuel boilers for space and water heating starting from 2029, and the revised EPBD aims at phasing out the use of fossil fuels for heating and air conditioning systems in buildings by 2040, which will also increase the push towards electrification.

Financial incentives are a key lever to overcome investment barriers. Progress should be made on phasing out fossil fuel subsidies, and on developing financial mechanisms that disincentivise investment into fossil fuel use. Meanwhile, there is a need for promoting early investment into compact, energy-, and resource-efficient electric vehicles and high-efficient heat pumps as well as into related infrastructure. In industry, additional action is needed on a comprehensive industrial electrification strategy on an EU level as well as on the national level, e.g., in the NECPs.

## The transition needs a further boost in investment

The transition to a climate neutral and resilient Europe requires substantial investment in climate – both mitigation and adaptation – to contain the long-term costs of climate impacts, which are already escalating. Despite a moderate rise in investments for climate change mitigation for the energy, buildings, and transport sectors, with increases of 15% in 2021 and 9% in 2022, the EU is still facing a significant investment gap of EUR 406 billion to meet its 2030 climate objective as of 2022. Currently, only about half of the annual investments needed to align with the 2030 climate target have been mobilised ([see 4.9](#)). While there has been a notable increase in private investment in clean technologies, both in early and late stages, investment in critical areas need to be accelerated to speed up the transition. This includes further investment in energy-efficient building renovations, installing electric heat pumps, expanding wind and solar power, enhancing the electricity grid, ramping up rail and public transport, as well as zero-emissions passenger vehicles and respective recharging stations. The assessment of investments in cycling infrastructure was hindered by a lack of available data – as is the case for investment needs, planned expenditures, and actual spending on adaptation.

To channel additional investment into clean technologies and services, the EU adopted a mix of different policies and programmes. This includes, but is not limited, to the Renewable Energy Directive and the Electricity Market Design Rule, which promote investment into renewable energies. To steer investment towards the decarbonisation of industry, the EU relies on a variety of programmes, including Horizon Europe, the Innovation Fund, the Connecting Europe Facility, and the Modernisation Fund. As part of its Urban Mobility Framework, the EU has also committed to stimulating, activating, and reinforcing investment in public transport through multiple funding instruments. In the buildings sector, the EU is promoting investment in energy-efficient buildings through the Energy Performance of Buildings Directive. In addition, regulations like the Capital Requirements Directive and the Corporate Sustainability Reporting Directive bolster investments in climate-friendly technologies by enhancing transparency and financial stability.

At the same time, the EU has also strengthened its mechanisms to disincentivise environmentally harmful investments. Key among these is CO<sub>2</sub> pricing through the EU ETS leading to higher operational costs when using fossil fuels. However, the share of revenues from environmental taxation in total tax revenue remained low.

While the EU Environmental Action Programme calls on Member States to cut subsidies for fossil fuels, these tripled between 2021 and 2022, reaching EUR 190 billion. This growth is mainly due to the recent energy crisis which led EU Member States to protect households and companies from the rise of energy prices. Significant potential remains to redirect public funding to support investments into climate mitigation and adaptation.

## Citizens at the centre of the transition

Positioning citizens at the centre of the transition to a climate neutral future facilitates buy-in for the many changes that the transition brings and ensures that costs and benefits are distributed fairly. Public support is also a precondition for political action, both directly through elections and through exerting pressure on governments (Schaffer et al., 2022). Pursuing ambitious plans without public support can result in resistance and ultimately provoke a backlash against climate measures particularly where people feel like they are disadvantaged because of the transition (Evans et al., 2024) ([see 4.10](#)).

The support of EU citizens for the climate agenda remains strong, and people are willing to take action themselves (see [4.11](#) and [4.7](#)). To ensure citizens resolve remains, the EU needs to ensure that no one is left behind, that people can participate in the transition as well as in decision-making.

Data analysis on the generation of jobs underscores a direct benefit citizens reap from the transition. In general, the employment in coal and heavy-industry regions was developing positively. Even though the pace of overall employment growth within environmental goods and services, as well as in renewable energy supply chains, remains **too slow**, there has been an improvement in the indicator classification compared to the previous year's assessment ([see 4.10](#)). However, material deprivation still improves far too slowly. Counter measures to the energy price spikes caused by the Russian invasion had a mixed impact on the indicators: EU Member States adopted more than 230 temporary measures to protect households and companies from the rise of energy prices. While the support focused more on the households than companies, thus contributing to mitigating the social impacts of the crisis, it has also been more concentrated on mitigating the short-term costs rather than supporting long-term investments. This is also reflected in decreased share of energy efficiency investments and higher fossil fuel subsidies (see [4.9](#) and [4.10](#)).

Taking people along on the journey to climate neutrality is also achieved by giving them the opportunity to participate in the transition. The level of participation can be measured with indicators such as the number of private solar panels on rooftops, community-administered windfarms, or the spread of repair cafés in municipalities. Citizens can further be encouraged to participate in the transition through the establishment of the right-choice infrastructure. Options for sustainable consumption need to be made available, e.g., through reliable public transport, affordable plant-based food items, and the supply of sustainable goods ([see 4.7](#)). Most of this information is not featured in this year's ECNO report due to scarce data or because related indicators have not been considered so far. However, for a better assessment of how well citizens participate, such indicators may be taken into account in future updates of this report.

And finally, participation also means to provide citizens with the chance to participate in decision-making. The progress towards meaningful public participation was found to be partially **on track** but difficult to assess. The development of citizens' climate assemblies seems to progress at the right speed given the novelty of these institutions in the EU; however, while all assemblies came with a clear mandate, only half saw a governmental response or had an outreach strategy. Regarding public consultation, data are scarce. The EU Regulatory Scrutiny Board has singled out the 'unbalanced inclusion of stakeholder feedback' as a shortcoming in the implementation of impact assessments generally ([see 4.11](#)).



## Excursion 1: A closer look at progress in four enablers towards a climate neutral future



This year's flagship report includes in-depth analyses of four enablers to better understand the broader systemic changes in Member States that are driving the EU trends. These are: **1) Implementing zero emission transport** in mobility, **2) Storing more carbon in trees** in carbon dioxide removals, **3) Channelling public funds away from fossil fuels** in finance, and **4) Creating job opportunities** in just transition ([see 5 for details](#)).

Looking at the trends across the four deep dives, it becomes apparent that Member States have strengths in different areas with significant variation in their state of progress. At the same time, the assessment of the different enablers highlights that national challenges can be quite similar – such as for bringing electric vehicles into the market and phasing out of fossil fuel subsidies – or quite diverse – such as for forest carbon sequestration and job opportunities ([see Table 2](#)).

Progress at the enabler level can thus also be encouraged through fostering exchange on good practices that can work across different Member States. In addition, although past progress has often been influenced by different factors in the Member States, some policies and solutions seem valid to pursue for all Member States – including more transparent planning to inform stakeholders and citizens alike:

- A good policy example includes the smart, fiscally neutral 'Bonus-Malus' systems for **promoting electric vehicles**, as implemented in France or Romania. These are structured in a manner that does not affect the fiscal budget, also allowing lower-income EU countries to support electric vehicles effectively. Such systems could also further incentivise car manufacturers to develop low-cost EVs.
- **Enhancing forest carbon sinks** seems to be a challenge across all Member States although reasons range from forest fires and heat-induced diseases to (illegal) logging and unsustainable forest management practices, and mixes thereof. However, a shift towards more near-natural forests with a greater mix in tree species, promoting biodiversity and the forests' adaptability to climate change, would benefit forests across the EU.



- Progress towards **phasing out fossil fuel subsidies** saw a backlash in recent years, and even phase-out plans are limited. Only Denmark sets out a comprehensive plan to phase out all fossil fuel subsidies. France and Germany at least plan to phase out 60%, and 50% respectively, by 2025.
- For **creating job opportunities**, Member States use up- and reskilling as well as training programmes. The implementation can be quite diverse, including special training for coal workers in Romania, supporting an exchange platform for education institutions and businesses in the Netherlands, to providing job guarantees in Austria.

While the four deep dives provide insights into national data, it is important to note that they cannot close existing research gaps in terms of (ex-post) policy assessment across the 27 Member States. Thus, the understanding of how far EU and/or national policies are responsible for the changes in data is lacking and could only partly be overcome here.

### Member States progress in the four deep dives

The adoption of **Zero and Low Emission Vehicles (ZEVs)** has significantly increased across all Member States, with most using financial incentives or bonus-malus systems, to promote their purchasing. However, the predominance of ZEVs in the high-priced vehicle segment means their uptake remains especially notable in Member States with greater purchasing power, such as Scandinavia and the Benelux countries. More than 50% of **charging points** are in the Netherlands, Germany, and France. The dense Dutch network results from a clear national agenda and ambitious subnational policies.

Despite recent signs of decreasing net LULUCF removals, **forest area and carbon stock in forest land** has grown between 2016 and 2021, mostly in France where the government also introduced its so-called low-carbon label to certify carbon removal projects. Additionally, Italy and Bulgaria are driving positive change in forest area, and Poland and Germany show promising developments in terms of growing carbon stock in forest land. Overall, there still is a lack of a coordinated forest policy framework, harmonising forest regulations across regions and fostering carbon sequestration and ecosystem restoration.

Amid the energy crisis of 2022, **fossil fuel subsidies** have risen in nearly all Member States except Finland, Romania, Luxembourg, and Bulgaria. While most plan to phase out these subsidies, the focus is often limited to the power sector and, to a lesser extent, the buildings sector, with other sectors mostly omitted from such plans. Germany and France have committed to exit fossil fuel subsidies but have not set a specific end-date for all. Denmark stands out as the only Member State having set out a comprehensive national plan to concretely phase out fossil fuel subsidies related to electricity generation, coal-fired power plants, and support in fossil heating systems.

The **employment rate in the regions most affected** by the transition is progressing at a pace that is similar to the pace for the whole EU. The rates in transitioning regions are on average markedly higher in the countries that are characterised by high overall employment. Thereby, country-level specific factors and policies may so far be more effective than JTF region-specific support. **Job creation in renewable energy** has increased most in Portugal, followed by Germany and Spain, with photovoltaics being the most employing technology. National programmes such as the 'Green Skills and Job Programme' in Portugal or a training academy in a former coal region in Romania are supporting this development.

## Excursion 2: Data availability under the emission curve

One major challenge **when looking under the emission curve** remains **data availability**. Key areas where the missing data leads to gaps in understanding the progress include (albeit not exhaustive):

- **Buildings** renovation concerns all EU citizens in terms of what they have to pay for their energy bills and comfort, but no data are available about the state of buildings in Europe.
- **Adaptation** is urgently needed to increase resilience and prevent losses and damage from climate change, but no data are available on actual actions and finance.
- Scarce data availability and the use of proxies in **lifestyles** make it hard to understand changes in daily choices.

Due to unavailability of official EU data in some cases, data from other sources had to be used, partly even from the research partners' own collection and compilation efforts. In other cases, the assessment partly falls back on proxy indicators that do not exactly provide the information desired but allow for an estimated assessment. Still, there are 36 indicators, or 29%, that do not have enough historical data to draw a trendline. In addition, progress is ideally assessed against a target or benchmark. This assessment only uses official EU-level targets and benchmarks drawing on a range of different sources, including EU Directives and Regulations, the Impact Assessments of the EU 2030 Climate Target Plan (EC, 2020a), and of the EU LTS, as well as a range of other documents including, e.g., the 8th Environmental Action Plan (EAP). However, some official targets need updating since the target year has already passed and others may not be fully in line with the path to reaching climate neutrality by 2050. For roughly two thirds of all indicators, there are currently no official EU-level targets or benchmarks.

The issue of missing data was partly overcome through qualitative assessments, allowing for nine indicators without historical data to be assessed and classified nonetheless. Qualitative assessments could also partly close the benchmark gap to provide a reasonable classification. However, such compensations should not hide the fact that historical data and agreed yardsticks, stemming from official, up-to-date pathways to climate neutrality, are needed for an accurate indication of progress and related insights for necessary course corrections. The lack of data availability means that the overall picture stays incomplete – and essential insights for policy-makers may be missing. Lack of progress, or the failure to lay the foundations for decisive change further along in the transition, may thus go unnoticed, jeopardising an effective and efficient transition.

Additional work is required to understand where data already exists but with restricted access, and where additional data could be collected – by whom and under which legislation – without adding an unnecessary burden on governments and/or businesses.

# 3 Key takeaways and policy implications

This section reflects on the results of the analysis and seeks to distil key takeaways on the state of the transition (3.1). Subsequently, 3.2 offers an overview of the areas in which targeted policy decisions would be required in 2024-2029 to speed-up the transition. The section closes with an argument for an official EU transition monitoring framework (3.3).

## 3.1 The state of the transition

This update of the state of the EU's progress towards its long-term goal of climate neutrality shows that the EU continues to move in the right direction overall, but that the pace is still **too slow** overall, with the building blocks showing the same pace as last year. However, there are changes – and mainly positive ones – in individual indicators, and a range of new policies are likely to further influence indicator development over time.

This means that the EU keeps progressing on its path to climate neutrality, upholding the vision of the European Green Deal. The energy and cost of living crises have further evoked the need to swiftly phase out oil and gas from Russia after the Russian invasion of Ukraine, making it obvious that key solutions to climate change also create more independence and energy security, resilience, and lower prices in the long-term.

The Green Deal policies promise an increase in the speed of progress, which will become visible in the data over time if implementation happens according to plan. Across the sectoral building blocks, EU policy has to date advanced particularly in electricity, industry and mobility. Among the cross-cutting building blocks, cleantech, just transition and governance show the most promising policy progress. However, there are blind spots in agrifood and in managing transport demand, where policy action is rather limited.

EU citizens support the net zero objective and related actions, but also find that government action is not adequate. This calls for fast and ambitious implementation of the Green Deal policies in Brussels as well as in all EU Member States to accelerate the just and inclusive transition to climate neutrality.

## 3.2 Actions for 2024–2029 EU policy

### 1: Advance effective implementation of the existing policies

The broad set of policies adopted in the past four years has now firmly moved the EU into the implementation phase. Policy implementation in Member States is mentioned as an action area in each building block. Follow through on the agreed policies is needed now to realise the intended impacts towards the transition. This includes:

- Updating national policies for supporting and better integrating renewables, including stable support schemes structured as contracts for difference (CFDs) and the continued removal of barriers especially around permitting and citing
- Implementing national planning and legislation on infrastructure development, including the Grid Action Plan
- National policy instruments and tools for the transition from linear to circular models
- Implementation of the Net Zero Industry Act
- Stepping up monitoring of adaptation action and implementing the Adaptation Strategy
- Better data through implementation of the new monitoring laws for forestry and soils
- Increasing national Official Development Assistance (ODA) allocated to climate action
- Adoption of national scientific advisory bodies and independent scientific review as well as effective and ongoing public and stakeholder engagement in policy processes

Better national implementation bases decision-making on timely and sufficiently detailed national long-term strategies (LTS), actionable national energy and climate plans (NECPs), comprehensive biennial progress reports (NECPRs), and permanent multi-level climate and energy dialogues as well as meaningful participation.

EU-level support to Member States, along with further specification of the legal requirements and stricter follow-up to ensure adherence is a key necessity for effective national implementation. EU support, guidance, and follow-up on implementation seems vital to ensure a just and cost-effective transition.

In addition, transparent processes, active communication and interaction, and no backtracking on already (almost) finalised and/or agreed policies are needed in order to avoid any uncertainty and ensure decision and investment security for companies and citizens. Any step-back and shortcomings in the implementation of the Green Deal policies risk hindering the unfolding of the intended impacts and thus a just and timely transition to climate neutrality.

## 2: Get the finance right for the transition

Insufficient financing is currently slowing down the transition towards climate neutrality, with investments needing to double to meet the EU 2030 climate target. A strong policy push is needed to redirect financial flows towards transition financing, including progressively phasing out fossil fuel subsidies, and to close the investment gap. Without a turn-around on finance and realising the necessary investments, the transition could fail.

Progress could be made by developing a new EU-level long-term transition financing plan. Such a plan should include EU public funding tools, utilised in alignment with the EU climate target. It should also explain the role of Member States' public funding to finance the transition, and how EU fiscal and budgetary rules would work for this. Additionally, this long-term financing plan should explain how existing regulations, such as the prudential regulation of the different carbon pricing systems in the EU, are sufficient to crowd-in private finance or whether they need to be strengthened. This long-term transition financing plan would also provide information on EU funds allocation within the next EU long-term budget, the Multiannual Financial Framework (MFF), for 2028 to 2034.

A key necessity for advancing progress is also redirecting financial flows from fossil assets to climate neutral ones, whereby the EU can support Member States in developing action plans with clear deadlines for phasing out fossil fuel subsidies and developing a framework for long-term climate subsidies. This would shift resources to supporting investments in climate-friendly solutions, which address the root causes of energy poverty and energy security risks.

## 3: Ensure a socially just and people-centred transition

EU citizens show strong support for climate action in surveys. To ensure citizens resolve remains, further progress is needed to ensure that no one is left behind and citizens can be heard in policy-making. A citizen-centric approach to decisions over the coming years could strengthen this dimension. Related actions would include developing job opportunities and creating adequate training programmes in relevant industries, as well as ensuring people have access to sustainable lifestyle options. Material deprivation and poverty can be better kept in check by moving from temporary protection instruments to structural measures that help manage distributional effects. Moreover, citizens should be given early and frequent opportunities to contribute to policy decisions. A critical starting point is improving national implementation of EU requirements, including public participation in climate policy planning and the establishment of permanent multi-level dialogues. All channels for engagement should be designed for impact with adequate political attention and follow-up. Finally, making these effective may require additional EU funding and capacity building. But more detailed and transparent reporting on the effectiveness of existing national practices is necessary to pinpoint areas for targeted EU support.

## 4: Accelerate the industrial transition as part of an EU competitiveness deal

Making EU industry fit for the age of net zero promotes innovation and increases international competitiveness and resilience over the long-term. The orientation towards an energy efficient and circular economy can serve as an innovation driver limiting raw resource use and increasing the resilience of the EU's manufacturing industrial base, while the shift to clean fuels, including renewables, electricity, and green hydrogen, reduces fossil fuel dependency and may further push the EU's cleantech manufacturing.

Provision of additional EU funding, especially for electrification, grid infrastructure, and energy efficiency, either within existing frameworks (e.g., Innovation Fund), by launching new funding tools or leveraging existing spending via improved green public procurement frameworks may accelerate the progress of the industrial transition in the EU. This support would help companies overcome financial obstacles to invest in and adopt and operate new and improved technologies. Further progress to advancing the industrial transition could be supported by comprehensive and consistent national energy and climate plans (NECPs) that consider the three enablers – circularity, energy efficiency, and clean fuels including electrification, especially regarding low temperature heat processes, and the necessary infrastructure. These plans can facilitate the successful implementation of existing policies in the context of national circumstances and enhance the optimal distribution of the funds.

## 5: Encourage efficiency, modal shift, and electrification in buildings and mobility

Progress was rather limited in buildings and mobility. While in both building blocks, CO<sub>2</sub> pricing through the new EU ETS2 and standards for new type buildings and vehicles have been introduced, additional action is needed to address the existing stocks. This is particularly relevant for lower-income households, which have to be able to reduce their fossil fuel consumption.

For buildings, the scope of the Energy Performance of Buildings Directive (EPBD) could be expanded to all existing buildings. The achievement of wide-spread deep renovation could be helped through effective compliance support and an enforcement system. To make the existing minimum energy performance standards more effective, accessible, and affordable, they should be integrated into a comprehensive ecosystem of supporting policy instruments. These should be tailored to the diverse needs of various target groups, including subsidies to address the financial barriers faced by low-income and vulnerable households as well as rental households.

In mobility, progress could be made by targeting high-mileage corporate fleets through incentivising stock turnover and higher shares of electric vehicles. Additional EU action can focus on supporting Member States in their national incentive schemes (subsidies and taxes) and in infrastructure development including charging points and rail and cycling networks through the Trans-European transport network proposal. Progress could also be

made through expanding the availability of and access to cross-border public transport and by following through on the financial commitments made in the European Declaration on Cycling. Progress towards managing motorised freight transport demand can build on encouraging local circular industry. This can include identifying synergies between the Sustainable and Smart Mobility Strategy, the Circular Economy Action Plan, and the subsidiary Circular Cities and Regions Initiative.

## 6: Ensure a predictable and just transition in agriculture

Across Europe, farmers expressed their concerns over the economic viability of their livelihoods in early 2024. At the same time, changes in current agricultural practices are essential to reaching climate neutrality. While farmers have started reorganising their businesses, a clear vision and reliable framework for the transition would further support their efforts. A predictable framework is also crucial to enhancing climate resilience, and respecting biodiversity while ensuring the production of healthy and sufficient agricultural products. Additionally, it must promote justice and inclusivity to support rural livelihoods.

Advancing progress in agrifood can build on a shift of public funding through the Common Agricultural Policy (CAP) to encourage low-emission, socially just and resilient agriculture. Standardised, stringent criteria for sustainable food procurement and a labelling framework, including front-of-pack nutrition labelling, would support healthier plant-based diets, which in turn must become readily and affordably available. This may also reduce the total number of livestock and associated land take and emissions. Further progress could be made by raising ambition and addressing inconsistencies in benchmarking for food waste reduction while escalating the voluntary status of the guidelines on responsible food business and marketing practices, developing a proposal for date marking, and mandating emission reduction from agrifood distributors and processors.

## 7: Invest in (natural) carbon dioxide removals urgently

Forests are currently the main sink of CO<sub>2</sub> emissions but are under pressure from climate change and related droughts, timber harvesting, and slowdowns in net afforestation. Besides some progress, there is a need to further expand sustainable forest practices and promote restoration, reforestation, and sustainable management – including a shift towards more near-natural forests. The EU should follow up on its own guidance to Member States on sustainable forest practices and their consideration and implementation. Progress could be made by addressing the risks of fast-growing plantation forests, encouraging a shift away from monoculture forests towards more near-natural forests with a greater mix in tree species, and promoting biodiversity and the forests adaptability to climate change. Any certified removals being used to account for residual emissions elsewhere will have to be of high integrity to ensure permanence. To secure the deployment of sustainable technical CDR post-2030, progress should be made towards research, development, and demonstration with a greater focus to be placed on full lifecycle impacts.

## 8: Enhance global climate action through climate finance and diplomacy

Global action is an essential part of successful climate policy and is also in the EU's interest. The EU plays an important role in enhancing global climate action by supporting partner countries in their green transitions. Further progress could be encouraged by strengthening existing partnerships, promoting sustainable trade practices, and setting stringent, transparent, equitable, and effective environmental standards. At the same time, the EU needs to deliver on its climate finance commitment to other countries to meet its historical responsibility and contribute equitably to the fight against climate change. This includes ensuring that the New Collective Quantified Goal (NCQG), intended to be set by the end of 2024, is responsive to the needs of developing countries. To reinforce its commitment to financing clean projects abroad, progress could be made through transforming the European Investment Bank into a true 'climate bank' by phasing out fossil fuel financing and supporting renewable energy, energy efficiency, and climate resilience. Finally, further efforts are needed for the EU to align all public funding with the goals of the Paris Agreement, integrate climate considerations into foreign policy, and leverage its influence in international forums and trade agreements to promote global decarbonisation efforts.

## 9: Improve data for smarter policy-making

Despite a clear framework to measure progress towards GHG emission reductions in the EU, there remain important data gaps when looking under the emission curve. 36 out of the 124 indicators assessing key objectives and enablers of the transition had insufficient data to know whether progress was or was not sufficient. These data gaps risk an accurate understanding of progress and related insights for necessary course corrections.

To enhance information for policy-makers, action is needed to close gaps in data needed to monitor the transition. Options include implementing new or better reporting obligations and adjusting data collection routines that also improve the efficiency of processes and spending. Streamlining existing reporting processes could help simplify processes, reduce the administrative effort, and free up capacity.

Large data gaps exist particularly in building renovation, lifestyles, and adaptation. In these areas, progress towards better data could be made, e.g., through accessible national databases for building energy performance to address the lack of up-to date data on the state of buildings and renovation. In lifestyles, data on EU funding for investments into enabling infrastructure could be considered in the (regular) assessment of EU funds. Enhancing adaptation monitoring, reporting, and evaluation practices in Member States can ensure that progress is tracked and regularly updated, providing relevant information on the state of adaptation on the grounds (e.g., length of restored rivers) and high-level policy and financial information (e.g., funding earmarked for adaptation measures).



### 3.3 An official EU transition monitoring

This assessment shows that a comprehensive tracking system can reveal where progress towards objectives and enablers of the transition is not fast enough, or even goes in the wrong direction. This information beyond checking GHG emission reductions helps to identify the areas that are most urgently in need of action and those that might lead to slow-down or blockage in the future. It also reveals blind spots and information gaps. These insights can inform policy-making by helping to identify policy gaps and setting priorities for the formulation of new policies, revising existing policies to align them better with a path to climate neutrality, as well as removing policies setting the wrong incentives.

The first progress assessment of the EC implementing Article 6.1 of the EU Climate Law explicitly recognises that ‘detailed monitoring is needed to assess progress on enabling factors that drive emissions in the different sectors to better highlight areas where progress is lacking or more action is needed’ (EC; 2023m, p. 10). However, the assessment falls short on covering such information (ECNO, 2024b), and the next one is only to be published in 2028. This will be too late for many decisions to be taken in the next five years.

While ECNO’s assessment provides detailed input for policy-makers, it cannot replace regular and sufficiently comprehensive EU-wide transition monitoring carried out by the EU institutions directly. Article 6 (3) of the EU Climate Law obliges the EC to act on insights from a monitoring of progress towards climate neutrality, but the current system cannot deliver the necessary information.

A revised EU transition monitoring framework could lead to greater comparability, facilitate evaluations, and increase transparency by integrating existing planning, monitoring, and reporting activities (e.g., EU statistics; monitoring of the 8th Environmental Action Programme or of the Energy Poverty Advisory Hub; the National Energy and Climate Plans (NECPs), long-term strategies (LTSS) and the national progress reports (NECPRs) under the Governance Regulation). This would allow for decisions based on a unified set of facts. It could reduce overall effort and administrative burden for Member States and EU institutions alike. The upcoming review and potential revisions of the EU Climate Law and the Governance Regulation may offer an opening for this.

More information regarding the recommendation for an improved official EU monitoring system and first ideas of its smart integration with other EU monitoring exercises can be found in the ECNO briefing ‘Towards an EU net zero monitoring framework. A review of the European Commission’s assessment of progress’.

# 4 Progress of 13 building blocks towards a climate neutral future

## SECTORAL BUILDING BLOCKS



## CROSSECTORAL BUILDING BLOCKS



Table 3: Building Blocks

BUILDING BLOCK	DESCRIPTION
 <b><u>Electricity</u></b>	Electricity powers modern societies, and its importance will only increase over time through the electrification of demand sectors. Renewable energies and their integration into the system are crucial.
 <b><u>Mobility</u></b>	Mobility connects people and sustains economies. For a transformative shift, reducing motorised transport, promoting clean modes, and decarbonising remaining transport are essential.
 <b><u>Industry</u></b>	The EU needs a globally competitive and sustainable industry for economic prosperity and security. Cutting emissions in industry will depend on availability of zero-carbon energy and feedstock carriers and infrastructure, circularity, and energy efficiency.
 <b><u>Buildings</u></b>	Buildings facilitate activities essential for human life and society. Optimising building services, renovating them, and transitioning to renewable technologies are crucial.
 <b><u>Agrifood</u></b>	Agrifood refers to all stages of the agricultural supply chain, from food production to consumption to disposal, while also considering aspects of land use and the production of agricultural inputs.
 <b><u>Carbon Dioxide Removal</u></b>	Carbon dioxide removal (CDR) is crucial to compensate for minimal residual emissions. It requires storing carbon in trees and soils and potentially using sustainable technical solutions in the future.
 <b><u>Lifestyles</u></b>	Sustainable behaviour patterns and social practices, enabled by policies that make sustainable options accessible, affordable, and the default, are key for decarbonisation.
 <b><u>Clean Technologies</u></b>	Clean technologies are the backbone of a decarbonised economy. It is vital to deploy the most effective climate solutions, and that citizens reap the benefits of green industrialisation.
 <b><u>Finance</u></b>	Redirecting financial flows towards the transition is essential to put the EU on track to achieve climate neutrality by 2050. This includes both public and private investment flows.
 <b><u>Just and Inclusive Transition</u></b>	Just transition refers to designing and executing the shift to climate neutrality in a fair and inclusive way. Job opportunities, regional policies, and managing distributional effects are essential to the process.
 <b><u>Governance</u></b>	Governance refers to the institutions, procedures, and frameworks used by governments to manage and guide policy-making and foster societal buy-in for the transition to climate neutrality.
 <b><u>Adaptation</u></b>	Climate adaptation is necessary to respond to unavoidable climate impacts. It requires implementing effective adaptation measures on the ground as well as supportive governance and financial frameworks.
 <b><u>External Action</u></b>	Addressing climate change requires a collective global approach. It is key for the EU to consider the extraterritorial impacts of its actions, prioritise climate diplomacy and support other nations in decarbonisation efforts.



# Electricity



## Too slow

Electricity powers modern societies, and its importance will only increase over time with the electrification of demand sectors. Renewable energies and their integration into the system are crucial.

# 4.1 Electricity



**Past progress:** The power sector decarbonisation continues to be **too slow** to be in line with the EU’s long-term climate target, unchanged from last year’s report. The increase in coal power generation in the aftermath of the energy prices crisis has temporarily increased emissions. But favourable weather conditions, continued uptake of renewable energy sources (RES) and lower demand have allowed the emissions to fall again in 2023. In many important areas that are enabling the transition of the electricity sector, the trends do not show sufficient progress yet. This includes investments into grid infrastructure, digitalisation efforts such as smart meters, the provision of non-fossil flexibilities, especially storage and demand-side management (DSM) or electrification of demand sectors.

**Policy context:** The EU has put policy frameworks in place in all major areas addressed in this report. The updated RES targets, permitting rules and revised guidance for power market design rules aim to further strengthen RES uptake. Other policy areas are far less advanced. Digitalisation and grid development are mainly supported at the EU level through the initiation of planning processes, but the slow uptake points to insufficient policy and/or implementation. While non-fossil storage and DSM have seen a significant policy push at the EU level, a trend towards fossil flexibility solutions, especially fossil gas, can be observed in capacity markets. The EU, through its taxonomy and other policies, is sending the wrong policy signals, enabling continued investments into fossil gas.

**Areas of action:** Member States need to update their currently largely insufficient RES targets in line with the RED III. A related proper national policy design, including policies to remove barriers for wind energy and to implement Contracts for difference (CFDs) would support continued RES uptake. Similarly, Member States need to further develop schemes to enable the uptake of non-fossil flexibility options, such as the creation of a level playing field in market-based solutions such as capacity mechanisms, and should consider setting flexibility targets. Efforts to enable the digitalisation of the grid, such as faster rollout of smart meters, need to be intensified and investments into the grid increased. All this needs to be paralleled by continued planning and coordination from EU level entities, such as the Agency for the Cooperation of Energy Regulators (ACER) and the EC.

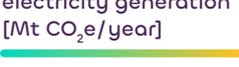
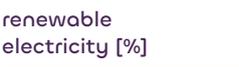
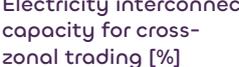
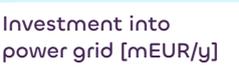
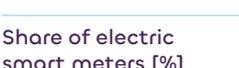
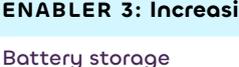
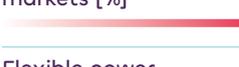
**Table 4: Progress in electricity towards the objective and enablers**

OBJECTIVE	ENABLERS		
Decarbonising electricity supply and phasing out fossil fuels 	Reforming electricity markets 	Building out, digitalising, and enhancing the grid 	Increasing demand and supply flexibility 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 5: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Decarbonising electricity supply and phasing out fossil fuels</b>						
 		GHG emissions of electricity generation [Mt CO <sub>2</sub> e/year]	2018–2023 (EEA, 2023b; Ember, 2024b)	-5.5% per year	-40.9 Mt per year	265.9 Mt in 2030 -47.4 Mt (2023–2030) → 1.2 times faster
 		Share of fossil fuel-fired power generation [%]	2018–2023 (Ember, 2024b)	-3.3% per year	-1.3%-points per year	17.1 % in 2030 (EC, 2020l) -2.2% points per year (2023–2030) → 1.8 times faster
 		Share of gas fired power generation [%]	2018–2023 (Ember, 2024b)	-0.5% per year	-0.1%-points per year	n/a n/a
 		Share of coal-fired power generation [%]	2018–2023 (Ember, 2024b)	-6.8% per year	-1.1%-points per year	n/a n/a
<b>ENABLER 1: Reforming electricity markets</b>						
 		Share of variable renewable electricity [%]	2018–2023 (Ember, 2024b)	11.6% per year	2.2%-points per year	47% in 2030 (EC 2020k) 3.1%-points per year (2023–2030) → 1.4 times faster
 		Electricity interconnector capacity for cross-zonal trading [%]	n/a	n/a	n/a	70% of capacity (ACER, 2022) n/a
<b>ENABLER 2: Building out, digitalising, and enhancing the grid</b>						
 		Investment into power grid [mEUR/y]	2021–2022 (EIB, 2024)	n/a	n/a	84 bn Euro per year between 2031–2040 (EC, 2024j) n/a
 		Share of electric smart meters [%]	2018, 2021, 2022 (Berg Insight, 2022, 2023; EC, 2020e)	14.8% per year	5.7%-points per year	n/a n/a
<b>ENABLER 3: Increasing non-fossil demand and supply flexibility</b>						
 		Battery storage capacity [GW]	2017–2022 (IEA, 2023h)	97.2% per year	1.3 GW per year	38 GW in 2030 (EC 2020k) 3.4 GW per year (2023–2030) → 2.5 times faster
 		Non-fossil participation in capacity markets [%]	2019–2023 (ACER, 2023b)	-7.2% per year	-4.9%-points per year	n/a n/a
 		Flexible power demand [GW]	n/a	n/a	n/a	n/a n/a
 		Share of electricity in final energy demand [%]	2017–2022 (Eurostat, 2024q)	0.09% per year	0.02%-points per year	49.5 % in 2050 (EC, 2024j) 1.2%-points per year (2023–2050) → 56 times faster

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Decarbonising electricity supply and phasing out fossil fuels

**Past progress:** Due to a temporary increase in 2022, power sector emissions have moved off track. However, 2023 has seen a reversal of this trend thanks to a growth in renewable electricity generation caused by a continued build-out of RES and favourable weather conditions (see enabler 1), but also due to decreasing electricity demand (Ember, 2024b). The phase out of fossil fuels continues to progress **too slowly**, and needs to double in speed by 2030 (see Table 5) (ESABCC, 2024). The share of coal generation increased both in 2021 and 2022 due to the energy crisis, but this trend was reversed in 2023, putting the EU back on track for a coal phase-out by 2035, which is five years later than the IEA net zero scenario suggests for the EU (IEA, 2023h) and two years behind the latest phase-out targets set by those Member States that have a target (Ember, 2024b). The share of gas has decreased over the last four years, but only started to decrease significantly in 2023. A continuation of the trend for gas power generation would not allow the EU to reduce unabated gas to zero by mid-century, let alone by 2035, as suggested by the IEA (2021b).

### Indicators:

- GHG emissions of electricity generation
- Share of fossil fuel-fired power generation
- Share of gas fired power generation
- Share of coal-fired power generation

**Policy context:** The EU Emissions Trading System (EU ETS) continues to be a major backbone for phasing out coal, and to a lesser extent gas. Recently it was revised to better align with the EU Climate Law's GHG emissions reduction targets – the annual linear emissions reduction factor was nearly doubled from 2.2% to 4.3% in 2024 and 4.8% in 2028. Despite this reform, the ETS price has decreased from a 2023 high of between 80 and 100 EUR/tCO<sub>2</sub> to around 60 EUR/tCO<sub>2</sub> at the beginning of 2024, likely due to the significant amount of surplus still in the system (EC, 2023k). At the same time, while the majority of Member States committed to phasing out coal by 2033 at the latest (Ember, 2024b), there is a lack of guidance from the EU to support Member States in reaching their targets (ESABCC, 2024). Other mechanisms that contribute to further reduce the role of fossil fuels include the proposed revision of the Energy Taxation Directive (EC, 2021h) or the Taxonomy Regulation.

**Areas of action:** The EU needs to further reform the ETS, including preparing the carbon market for when the cap reaches zero (ESABCC, 2024) and reducing its complexity (Borghesi et al., 2023). For advancing the coal phase-out, the EU should outline EU fossil fuel phase-out targets in line with the long-term strategy and/or support Member States with their own targets. Remaining loopholes that continue to enable fossil gas investments, such as the inclusion of fossil gas as a sustainable investment under the taxonomy or vaguely formulated condition (e.g. concerning CCS readiness, blending of fossil gas with hydrogen, or definition of low carbon gases as only partially reducing GHG emissions), need to be addressed. Additionally, direct or indirect subsidies, such as under the Temporary Crisis and Transition framework, need to be discontinued and the EU Industrial Emissions Directive could be further reformed to exploit synergies between depollution and decarbonisation (ESABCC, 2024).

## Enabler 1: Reforming electricity markets

**Past progress:** The share of the variable renewables, wind and solar, in electricity generation continues to increase, but progress is still **too slow** for the EU's trajectory toward climate neutrality (Table 5). On average, it increased 2.2%-points per year over the last five years, a significant increase of 0.6%-points over last year's report and the reason why the enabler moved from **"far too slow"** to **"too slow"**. Build-out of wind continues to be moderate at 17 GW in 2023 (WindEurope, 2024) at about half of what the IEA (2022a) suggests is needed, but together with favourable wind conditions in 2022 and 2023 compared to 2021 (Ember, 2024b) contributed to an average increase of 1.2%-points per year. Solar continues to surpass its forecasted installed capacity figures at 56 GW new capacity in 2023 (IEA, 2022a; SolarPower Europe, 2024), contributing 1%-points per year to the increase. While the integration of European electricity markets is a central part of the market design reform to enable the uptake of renewables, there continues to be a lack of indicators with good data quality and data availability (EC, 2023af).

### Indicators:

- Share of variable renewable electricity
- Electricity interconnector capacity for cross-zonal trading

**Policy context:** The EU has intensified its efforts to address the major barriers to RES deployment (IEA, 2022a). The RED III sets an updated EU wide RES target of 42.5% by 2030 (aiming for 45% and including a capacity target for innovated RES of 5%), requiring Member States to transpose its provisions into law within 18 months. The Directive also includes provisions on speeding up permitting procedures (along with EC, 2022a) by establishing common rules, creating renewable acceleration areas and providing technical assistance to Member States on the matter (ESABCC, 2024). The new close-to-adoption Electricity Market Design Rule (EC, 2023af) further clarifies that Member States are to use 'Contract for Differences (CFDs)' as the instrument to support renewable uptake, and further supports the establishment of long-term contracts. Furthermore, the EU also explicitly targeted wind power deployment under its Wind Power Action Plan (EC, 2023o), and the improvement of the RES value chains through its Net Zero Industry Act proposal (ESABCC, 2024) (see 4.8).

**Areas of action:** With key policies in place to address the major barriers to renewable uptake, the EU should intensify its efforts in supporting innovative zero-carbon energy solutions through, for instance, changes to the market design. In addition, Member States must translate EU policy into national policies to have any impact, which the EU should further facilitate through coordination and harmonisation of market design and support mechanisms across Member States. National implementation should aim at including stable support schemes structured as CFDs and the continued removal of barriers especially around permitting and citing. This is especially important for wind energy through, for instance, well-designed permitting processes with stakeholder engagement (ESABCC, 2024).

## Enabler 2: Building out, digitalising, and enhancing the grid

**Past progress:** Investments into the electricity grid continue to increase in the EU (IEA, 2023g), but it remains difficult to judge to what extent these are sufficient to be in line with the long-term climate target due to a mismatch in the scope of the data (EC, 2018, 2020l, 2024j). Other studies suggest that grid investments need to increase by between 15% (EC, 2020k), 50% (ESABCC, 2024) or even need to double if electrification is to become a stronger backbone (Kreusel et al., 2022). There is a consensus that significant investment is required, particularly for the distribution grid. (ESABCC, 2024; Rack, 2021). The share of smart meters, enabling prosumer participation and being an instrumental part for the digitalisation of the grid, continues to grow, but at a pace that is **far too slow**.

### Indicators:

- Investment into power grid
- Share of electric smart meters

**Policy context:** The Grid Action Plan (EC, 2023t) identifies measures to accelerate investments, including improved access to finance, faster permitting, better long-term planning and the identification of project of common interest (PCIs). The revised TEN-E Regulation addresses cross-border links and smart grids as the backbone of EU electricity planning. It includes provisions for faster permitting of transmission projects and provides an incentive structure for certain types of transition projects (ACER, 2023a). The EU continues to work on its Ten-Year Network Development Plan (TYNDP) (ENTSO-E; ENTSO, 2023), aiming to better harmonise grid planning across the EU. It will be published by the end of 2024 but has already been criticised for not being aligned with the long-term climate target of the EU (ESABCC, 2024). The EU action plan on digitalising the energy system (EC, 2022d) lays out important measures, such as increasing consumer control through digital tools.

**Areas of action:** The Grid Action Plan is a step in the right direction but now needs to be implemented to ensure investments are happening. A continued coordination and integration of grid planning, in light of achieving the climate targets, is needed as well as a stronger focus on operating the electricity system as a whole (ESABCC, 2024). The EU should continue to support Member States in identifying and developing grid projects, with a focus on permitting and/or other means of risk mitigation. The EU should also support countries in identifying and implementing the most cost-efficient grid projects, including those that could reduce costs but are currently missing (ACER, 2023a; ESABCC, 2024). Furthermore, the EU needs to continue to support Member States in overcoming barriers to the implementation of the digitalisation plan. Electrification needs to be accelerated significantly and prioritised, where possible, over hydrogen solutions, which currently sometimes seem to have a higher priority (ECNO, 2024c). Effective direct electrification support is a major gap at the EU level (ESABCC, 2024).

## Enabler 3: Increasing non-fossil demand and supply flexibility

**Past progress:** There continues to be a lack of comprehensive data on demand and supply flexibility. Indicative targets for energy storage suggest a need of 200 GW by 2030 (EC, 2023al); similar figures do not exist for demand flexibility. A look at the development of battery storage capacity highlights that progress is **far too slow**

(Delta-EE, 2022; IEA, 2023h). This is especially critical as flexibility needs are predicted to double by 2030 (EEA & ACER, 2023; ESABCC, 2024). Non-fossil flexibility is decreasing in existing capacity mechanisms (mainly due to the introduction of the natural-gas focused mechanism in Italy in 2022), i.e. heading in the **wrong direction**, and new flexibility sources such as DSM, dispatchable RES and storage, start from a low level and are picking up far too slowly. Also, electrification is advancing **far too slowly**, with the share of electricity in energy consumption having stagnated in the last five years.

### Indicators:

- Battery storage capacity
- Non-fossil participation in capacity markets
- Flexible power demand
- Share of electricity in final energy demand

**Policy context:** The EU continues to mainstream storage and DSM across a broad set of Directives (RED III, EED, EBPD). The RED III addresses faster permitting of storage facilities, including designated areas, the integration of DSM, such as EVs, workforce development and a level playing field for participation in energy markets amongst other things. The close-to-adoption Electricity Market Design Rules (EC, 2023af) would further support the creation of a level playing field for flexibility services, thus enabling market-based solutions for DSM and energy storage. Both documents call on Member States to support DSM and storage, with further guidance provided on how Member States can support energy storage (EC, 2023al). Furthermore, system operators are currently working on new rules that aim at facilitating the market participation of flexibility options (EEA & ACER, 2023). Hydrogen, which is also likely to play an important role in future flexibility, has seen a significant push in the RED III and EC communications (EC, 2020c, 2022l, 2022f). Electrification of end-use sectors is encouraged through the RED III and particularly sectoral policies.

**Areas of action:** While the EU has taken significant actions to enable storage capacity uptake with notable success, its efforts to support DSM have been far less successful. As a first step, the EU could set clear targets for energy storage and DSM at the EU level (Colthorpe, 2022). Creating a level playing field for flexibility options through, for instance, further reforming (and implementing) capacity mechanisms or strengthening of short-term markets is essential to ensuring the uptake of these options. Furthermore, there is a need for a push in innovation, especially around long-term storage capacity. The EU needs to continue to help Member States to identify and overcome barriers and foster collaboration to provide better flexibility services, especially at the distribution grid level. DSM, as the most cost-effective option for flexibility, should be considered more, removing barriers to involvement of consumers (ESABCC, 2024). The EU should support Member States in passing incentives for consumers to actively adopt their consumption, thus enabling the electrification to be flexible (EEA & ACER, 2023).



# Mobility



**Far too slow**

Mobility connects people and sustains economies. For a transformative shift, reducing motorised transport, promoting clean modes, and decarbonising remaining transport is essential.

## 4.2 Mobility



**Past progress:** Progress towards climate neutrality in the mobility sector was still **far too slow** in the assessed period, but there are promising signs of improvement for many enablers. Pandemic-induced emission reductions are rebounding but remain below pre-pandemic levels. Overall, the growth in passenger and freight transport demand somewhat slowed. COVID-19 negatively impacted the modal split of passenger transport, but passengers seemed to slowly be shifting back from road to rail transport again. The modal split for freight transport was still heading in the **wrong direction**. Although increasing, the pace of zero emission vehicle (ZEV) adoption and infrastructure buildout was still **far too slow** ([see 5.1](#)).

**Policy context:** Transport policy at the EU level has largely focused on implementing zero and low emission motorised transport (ECNO, 2024b). The EU has an ambitious vision for ZEVs (EC, 2020g) and is backing it up with stricter CO<sub>2</sub> emission performance standards and the Alternative Fuels Infrastructure Regulation (AFIR). However, the EU could make further progress by going beyond deploying ZEVs: overall motorised transport volumes need to be reduced and, where motorised transport is unavoidable, a greater modal shift for passenger and freight transport from road to rail needs to be facilitated. The proposed revision of the Trans-European transport network (TEN-T) is the EU’s first and primary tool for enabling a union-wide modal shift (EC, 2021c). Reducing motorised transport demand is key to reducing GHG emissions from transport, but the EU’s Sustainable and Smart Mobility Strategy (SSMS) (EC, 2021m) does not consider moderating motorised transport demand (ESABCC, 2024).

**Areas of action:** To become climate neutral by 2050, ZEV uptake could be facilitated by building out recharging infrastructure, providing guidance on financial incentives, and addressing gaps in the CO<sub>2</sub> emission standards. To address the policy gap for managing the demand for motorised transport and further incentivising the modal shift away from road transport, the EU could incorporate transport demand moderation into the SSMS and adopt the revised TEN-T. The EU could also be more active in coordinating non-motorised transport infrastructure, and in rural areas, in expanding rail networks.

**Table 6: Progress in mobility towards the objective and enablers**

OBJECTIVE	ENABLERS		
Reducing GHG emissions and carbon intensity in the transport sector 	Managing motorised transport demand 	Enabling modal shift 	Implementing zero emission transport 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. [See Table 35](#) for further information.  
 Source: ©ECNO.

Table 7: Details on indicators' past progress and required change

2023 2024 >	Historical data			Required change	
	Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Reducing GHG emissions and carbon intensity in transport</b>					
GHG emissions from transport [MtCO <sub>2</sub> e] 	2017–2022 (EEA, 2024b)	-2.3% per year	-20.6 MtCO <sub>2</sub> e per year	92% reduction by 2050 relative to 2005 (EC, 2018)	-29.7 MtCO <sub>2</sub> e per year (2022–2050) → 1.4 times faster
Carbon intensity of passenger transport [tCO <sub>2</sub> /pkm] 	n/a	n/a	n/a	n/a	n/a
<b>ENABLER 1: Managing motorised transport demand</b>					
Total passenger transport volume [passenger-km] 	2016–2021 (Eurostat, 2023f)	-5.5% per year	-310,448 pkm per year	7.4 bn pkm in 2050 (EC, 2018)	95,014 pkm per year (2021–2050) → can still increase
Total freight transport volume [million tonne-km] 	2017–2022 (Eurostat, 2023c)	1.4% per year	32,455 Mt-km per year	3.2 bn Mt-km in 2050 (EC, 2018)	28,267 Mt-km per year (2022–2050) → 0.9 times lower
<b>ENABLER 2: Enabling modal shift</b>					
Share of passenger transport volume on road [%] 	2016–2021 (Eurostat, 2023f)	2.2% per year	1.7%-points per year	75.2% share by 2050 (EC, 2018)	-0.4%-points per year (2021–2050) → needs U-turn
Share of passenger transport volume on rail [%] 	2016–2021 (Eurostat, 2023f)	-4.1% per year	-0.3%-points per year	9.6% share by 2050 (EC, 2018)	0.1%-points per year (2022–2050) → needs U-turn
Share of freight transport volume on road [%] 	2016–2021 (Eurostat, 2023e)	0.8% per year	0.6%-points per year	68.7% share by 2050 (EC, 2018)	-0.3%-points per year (2021–2050) → needs U-turn
Share of freight transport volume on rail [%] 	2016–2021 (Eurostat, 2023e)	-2.1% per year	-0.4%-points per year	24.1% share by 2050 (EC, 2018)	0.2%-points per year (2021–2050) → needs U-turn
<b>ENABLER 3: Implementing zero emission transport</b>					
Share of EVs in passenger car stock [%] 	2017–2022 (EAFO, 2024b)	57.9% per year	0.4%-points per year	99% by 2050 (EC, 2020g)	3.5%-points per year (2022–2050) → 8.4 times faster
Share of ZEVs in heavy-duty vehicle stock [%] 	2017–2022 (IEA, 2023a)	138.3% per year	0.01%-points per year	70% by 2050 (EC, 2020g)	2.5%-points per year (2022–2050) → 444 times faster
Share of ZEVs in new passenger car registrations [%] 	2017–2022 (EEA, 2023f)	66.5% per year	4.5% -points per year	100% by 2035 (EC, 2023aj)	6.0%-points per year (2022–2035) → 1.3 times faster
Total number of recharging points [#] 	2018–2023 (EAFO, 2024b)	192.3% per year	151,975 recharge points per year	16m recharge points by 2050 (EC, 2021b)	579,123 points per year (2023–2050) → 3.8 times faster

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; see Table 35 for further information. n/a indicates that data are not available. The COVID-19 pandemic induced unprecedented, but temporary changes in transport patterns that resulted in the manual reclassification of the progress status of indicators; EVs include battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and plug-in hybrid vehicles (PHEVs); ZEV include all EVs as well as hydrogen combustion engine vehicles (H2-ICEVs).

Source: ©ECNO.

## Objective: Reducing GHG emissions and carbon intensity in transport

**Past progress:** Overall, GHG emission reductions in transport were **far too slow**, excluding the extraordinary impacts of the COVID-19 pandemic on mobility and considering the already apparent rebounding of GHG emissions after 2020. The 2022 emission data included in this report further showcase the post-pandemic rebounding of GHG emissions from transport. Over the next three decades, emission reductions need to occur 1.4 times faster to meet the EU's 2050 target of a 92% reduction in GHG emissions relative to 2005 levels (EC, 2018). The state of reducing carbon intensity of passenger transport could not be assessed because of the lack of EU-wide data.

### Indicators:

- GHG emissions from transport
- Carbon intensity of passenger transport

**Policy context:** To ensure climate neutrality in the transport sector by 2050, the EC developed the SSMS, which lays out milestones for 2030 that focus on scaling up high-speed rail and ZEVs. (EC, 2021j). To accelerate the diffusion of ZEVs, the EU has also strengthened the CO<sub>2</sub> emission performance standards for light-duty vehicles. Absent from the SSMS is a milestone to reduce or moderate the demand for motorised transport. As part of the Fit for 55 package (EC, 2021b) and to complement the Green Deal and the SSMS, the EU recently extended the Emissions Trading System (ETS 2), which, starting in 2027, will disincentivise high-emission fuels through its carbon pricing mechanism and accelerate the phase-out of older, polluting vehicles. To further reduce emissions, the proposed Energy Taxation Directive (EC, 2021l) would align energy tax levels based on fuel type and increase the minimum tax level on diesel and petrol.

**Areas of action:** Transport policy at the EU level focuses primarily on implementing zero emission and low carbon transport and, to a lesser degree, on shifting transport modes (ECNO, 2024b). However, there exist significant policy gaps for managing, reducing, and avoiding motorised transport volumes. Since 2000, growing transport volumes have been the primary driver in increasing GHG emissions from road transport (EEA, 2022a). Therefore, reducing transport volumes, especially for emissions-intensive road transport, is critical for reaching the EU's 2050 climate neutrality target. Given that the EU's population is expected to grow until 2030 (Eurostat, 2019), reducing the absolute GHG emissions in the transport sector will become increasingly challenging. To ensure that EU-level policies and regulations have the desired effect, both overall GHG emissions and the carbon intensity of passenger transport should be considered—the composite value of emissions per passenger kilometre—which may enable a more nuanced understanding of the interplay of socioeconomic factors in the transport sector.

## Enabler 1: Managing motorised transport demand

**Past progress:** Progress towards managing motorised transport demand for freight and passengers was mixed. The onset of the COVID-19 pandemic caused a sharp decline in total passenger transport volumes. The sudden contraction of passenger transport volume heavily skews the trend data.

Taking into account the annual 6% growth rate of the EU's passenger transport volume between 2015 and 2019 and the visible post-pandemic rebounding of passenger transport volume in 2021, the progress towards this indicator was deemed to be **too slow**. Additionally, given that the number of passenger cars per EU inhabitant increased to a record-high 0.56 in 2022—up from 0.49 cars per resident in 2012 (Eurostat, 2024m)—and that Europe's population will continue to grow until 2030 (Eurostat, 2019), union-wide demand for motorised transport is likely to continue increasing. Freight transport volume was less impacted by COVID-19: freight volume continued to increase but at a slower rate; a rate that is nearly compatible with the EU's 2050 climate neutrality target (EC, 2018).

### Indicators:

- Total passenger transport volume
- Total freight transport volume

**Policy context:** The EU has not set official targets for managing overall transport volumes and does not recognise the moderation of transport demand as a policy option (ESABCC, 2024). This policy gap can partially be attributed to the fact that the demand for and volume of motorised passenger transport is most immediately managed by urban planning at the municipal and regional level instead of at the EU level. The proposal to revise the TEN-T and the EC's adoption of the European Declaration on Cycling (EC, 2023f) are first steps towards reducing motorised transport volumes. The TEN-T revision calls for the development of sustainable urban mobility plans (SUMP) for over 400 cities along the network. In its declaration on cycling, the EU recognises the need to increase funding for cycling infrastructure.

**Areas of action:** The pandemic spurred an unprecedented demand for cycling in Europe: between 2019 and 2020, bicycle sales reached a record high of over 22 million units, and sales of Electrically Power Assisted Cycles (EPACs) increased by 33.5% across the 27 Member States and the UK (CONEBI, 2021). Therefore, the sale of EPACs outpaced the growth of battery EV sales in the EU for the same period (EAFO, 2024b). To begin leveraging this positive trend, the EU could formally adopt the revised TEN-T proposal and follow through on the financial commitments made in the European Declaration on Cycling to support Member States and municipalities in increasing the modal share of active mobility. Motorised freight transport demand could be reduced by encouraging local, circular industry. To do so, the EU could identify synergies between the SSMS and the Circular Economy Action Plan and the subsidiary Circular Cities and Regions Initiative (EC, 2020h).

## Enabler 2: Enabling modal shift

**Past progress:** The modal split in passenger and freight transport was headed in the **wrong direction** in the assessed period. For passenger transport, the pandemic triggered an unprecedented shift away from public mobility towards private cars. This year's report includes data from 2021 which indicate the beginning of the return to positive pre-pandemic passenger transport trends. Although these post-pandemic trends appear favourable, the rate at which passengers are switching from cars to trains must be further expedited. The modal split in freight transport volume was largely unaffected by the pandemic: the share of freight transported by road was steadily increasing, while the shares on rail and inland waterways were decreasing. This represents a modal shift that is trending in the opposite direction of what is needed to further reduce sectoral GHG emissions.

### Indicators:

- Share of passenger transport volume on road
- Share of passenger transport volume on rail
- Share of freight transport volume on road
- Share of freight transport volume on rail

**Policy context:** The EU-level policy portfolio for facilitating a modal shift in the transport sector has been limited but recently expanded by the proposed revision of the TEN-T. The proposal stipulates the completion of the extensive long-distance, cross-border passenger and freight rail network by 2050. It aims to connect 430 cities and all major EU airports by passenger trains travelling at least 160km/h. In its Urban Mobility Framework, the EU commits to activating and reinforcing multiple funding instruments for public transport in municipalities (EC, 2021q). The TEN-T revision additionally calls for an increase in the number of freight trains in the EU and ensures international integration for dedicated rail freight corridors. In 2023, the EC announced the Combined Transport Directive and the Green Freight Package, offering financial support for freight operations that reduce road transport emissions by adopting intermodal transport models (EC, 2023aa). The TEN-T revision and this financial incentive are the first steps in facilitating a shift from road to rail for freight transport in the EU.

**Areas of action:** Beyond reducing the emissions from road transport, the EU can also make progress towards its 2050 climate neutrality target by shifting more road transport onto rail (Rudolph et al., 2023). Although the EU is expanding the development of multimodal inter- and intra-city rail networks, there exist significant gaps in the buildout of rail infrastructure in rural areas, which account for 80% of the EU's total territory (EPRS, 2022). For passenger transport, the underinvestment in rail and other forms of public transport in rural areas has birthed transport deserts, in which residents are locked into car ownership and usage (EUUMO, 2023). Since freight and passengers are transported on the same rail lines in Europe (Clausen & Voll, 2013), the absence of rural rail networks means that freight can often only be transported on roads. Significant increases in investments in rural rail infrastructure could facilitate the necessary modal shift for passenger and freight transport.

## Enabler 3: Implementing zero emission transport

**Past progress:** Overall progress towards implementing zero emission and low carbon transport at the EU level is improving but was still **far too slow** in the assessed period. ZEVs must make up 99% of the total share of passenger cars, while the share of ZEVs in the heavy-duty vehicle (HDV) stock needs to increase to 70% by 2050 (EC, 2020g) to be compatible with climate neutrality. To reach this level of uptake, the annual increase in ZEV uptake needs to occur 8 times faster for passenger vehicles and 444 times faster for heavy-duty vehicles than the current rate. The share of ZEVs in new passenger car registrations reached a record high in 2022 and was increasing by 4.5%-points per year. However, the growth rate was still **too slow** and needs to be increased to 6%-points per year. The number of recharging stations increased by over 190% per year between 2018 and 2023, but this development needs to accelerate by 3.8 times to be compatible with the EU's target of approximately 16 million public recharging points in 2050.

### Indicators:

- Share of EVs in passenger car stock
- Share of ZEVs in heavy-duty vehicle stock
- Share of ZEVs in new passenger car registrations
- Total number of recharging points

**Policy context:** To stimulate the uptake of ZEVs, the EU strengthened its fleet-wide CO<sub>2</sub> emission performance standards in 2023. Starting in 2035, the CO<sub>2</sub> emission target for all new passenger cars and vans is 0 g CO<sub>2</sub>/km. By doing so, the EU technically enacted a phase-out target for new internal combustion engine (ICE) vehicles. However, negotiations are ongoing to allow for ICE vehicles powered by CO<sub>2</sub>-neutral fuel powertrains to qualify as zero emission vehicles after 2035, which may weaken the standards' emission reduction potential. Although not adopted yet, an agreement was reached in 2024 to increase the CO<sub>2</sub> emission reduction targets for HDVs to 65% by 2035 and 90% by 2040 (EC, 2023ae). The revised AFIR complements the updated CO<sub>2</sub> emission standards by establishing distance-based targets for light- and heavy-duty recharging stations—every 60 km and every 100 km, respectively—along the TEN-T road network. The EC has recommended raising the weight limit for HDVs using zero-emission technologies to incentivise heavy-duty ZEVs, which rely on heavier powertrains (EC, 2023ai).

**Areas of action:** The uptake of ZEVs needs to be accelerated. Expanding financial support and infrastructure development could expedite uptake. The CO<sub>2</sub> emission standards could be further strengthened if the EU maintains a clear definition of ZEVs and, therefore, does not classify low emission vehicles that use plug-in hybrid drivetrains or carbon-neutral fuels as zero emission. Carbon-neutral fuels are best reserved for aviation and maritime shipping, where such fuels are likely critical for decarbonisation. EU policies could go beyond targeting new vehicle sales by incentivising stock turnover in the existing ICE fleet of LDVs and HDVs; in particular, the EU could target high-mileage corporate fleets and leverage the revised ETS. Ratifying the proposed emission standards for HDVs could accelerate ZEV adoption for freight transport. The EU could provide guidance based on good practices in vehicle subsidies and taxes at the national scale and in infrastructure and behavioural policies at the municipal scale, which are particularly effective in increasing vehicle uptake (Wappelhorst et al., 2020).



# Industry



**Far too slow**

The EU needs a globally competitive and sustainable industry for economic prosperity and security. Cutting emissions in industry will depend on availability of zero-carbon energy and feedstock carriers and infrastructure, circularity, and energy efficiency.

## 4.3 Industry



**Past progress:** The development in the EU industrial sector was **far too slow** in the period assessed, which means there is no change to the classification from last year. Nevertheless, progress accelerated in many areas, notably regarding GHG emission reductions, share of zero-carbon energy carriers, and energy efficiency of industrial processes. Importantly, the assessed data ends in 2022, the year in which the sector still increased its activity compared to 2021 despite the onset of the energy crisis. The positive changes were partly a consequence of the global energy markets’ volatility observed after Russia’s full-scale invasion of Ukraine in February 2022. For that reason, and due to the sluggish progress in circularity and persisting significant data gaps for availability of zero-carbon energy sources and infrastructure, ECNO’s assessment of progress has not changed, yet might in the next report if the latest trends persist.

**Policy context:** The EU’s legislative framework for industrial transition spans multiple policies. The reforms in the ‘Fit-for-55’ package aim at enhancing ambition: the revision of the Emissions Trading System (ETS) Directive and the Carbon Border Adjustment Mechanism (CBAM) will provide a stronger carbon pricing signal for industrial enterprises to cut emissions, while the revisions of Renewable Energy and Energy Efficiency Directives stimulate energy savings and uptake of renewable energy sources. The sector is also impacted by the revision of the Energy Performance of Buildings Directive (EPBD), including stricter requirements concerning lifecycle carbon footprint of buildings. Policy support for scaling up the production of the EU’s cleantech and industrial decarbonisation technologies is a part of the Green Deal Industrial Plan, with the Net Zero Industry Act (NZIA) and Strategic Technologies for Europe Platform (STEP) as headline sets of measures (which do not involve financial instruments). The Circular Economy Action Plan (CEAP) and the Industrial Carbon Management Strategy (ICMS) are strategies that outline planned actions to enhance circularity and the deployment of carbon capture and storage (or use) technologies. Finally, the 2024 revision of National Climate and Energy Plans (NECPs) is a step towards implementing these policies at the national level.

**Areas of action:** For industry, a key focus area is the effective implementation of recently introduced policies. To accelerate the industrial transition, sufficient financial support is needed, especially for electrification, infrastructure, and energy efficiency. Special political attention should be paid to enhancing circularity and green public procurement. Finally, comprehensive monitoring is needed to track progress in availability of zero-carbon energy sources and infrastructure.

**Table 8: Progress in industry towards the objective and enablers**

OBJECTIVE	ENABLERS		
Progressing towards net zero industrial GHG emissions with clean energy and feedstock carriers 	Ensuring availability of zero-carbon energy and feedstock carriers and infrastructure 	Boosting circular economy 	Enhancing energy efficient industrial processes 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 9: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Progressing towards net zero industrial GHG emissions with clean energy carriers</b>						
GHG emissions from industry [MtCO <sub>2</sub> e]		2017–2022 (EEA, 2023b)	-2.3% per year	-17.8 MtCO <sub>2</sub> e per year	97% reduction compared to 2015 value, by 2050 (EC, 2020a)	-23.9 MtCO <sub>2</sub> e per year (2022–2050) → 1.3 times faster
Share of clean energy carriers in energy and feedstock use [%]		2017–2022 (Eurostat, 2024c)	0.7% per year	0.2%-points per year	n/a	n/a
<b>ENABLER 1: Ensuring availability of zero-carbon energy and feedstock carriers and infrastructure</b>						
Annual production of renewable hydrogen for industrial use [t]		n/a	n/a	n/a	n/a	n/a
Amount of CO <sub>2</sub> captured [tCO <sub>2</sub> /yr]		n/a	n/a	n/a	n/a	n/a
<b>ENABLER 2: Boosting circular economy</b>						
Circular material use rate [%]		2017–2022 (Eurostat, 2024b)	-0.1% per year	-0.01%-points per year	23.4% by 2030 (EC, 2020h)	1.5%-points per year (2022–2030)
Resource productivity [PPS/kg]		2017–2022 (Eurostat, 2024p)	3% per year	0.1 PPS/kg per year	n/a	n/a
<b>ENABLER 3: Enhancing energy efficient industrial processes</b>						
Final energy consumption in industry [Mtoe]		2017–2022 (Eurostat, 2024c)	-1.3% per year	-4.3 Mtoe per year	n/a	n/a
Energy intensity of output [Mtoe/EUR]		2017–2022 (Eurostat, 2024c, 2024l)	-2.3% per year	-0.003 Mtoe per year	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Progressing towards net zero industrial GHG emissions with clean energy carriers

**Past progress:** Progress toward the objective was assessed as

**far too slow** (see Table 9), even though, compared to last year, progress accelerated both for reducing GHG emissions from industry and increasing the share of clean energy carriers in the overall energy and feedstock use in industry. The latter headed marginally in the **wrong direction** in the previous assessment, but a significant annual decrease in total energy consumption in industry (by over 9% in 2022, while the sectoral economic activity increased by 3%), driven mostly by a decrease in conventional energy carriers, contributed to a reversing of the indicators dynamics. Overall, the pace of progress in the period assessed was still **far too slow** to reach the EU climate targets. The pace of industrial GHG emission reductions almost doubled compared to last year, but the improvement is still **too slow** to be compatible with reaching the 2050 climate neutrality target.

### Indicators:

- GHG emissions from industry
- Share of clean energy carriers in energy and feedstock use

**Policy context:** The GHG emissions from industry are to a large extent covered by the EU ETS. Its revision, adopted in 2023, will reduce the supply of allowances to reach alignment with the new 2030 climate target, thus stimulating deeper GHG emission reductions. The planned phase-out of free allocation of allowances for industry starting in 2026 is coordinated with the introduction of CBAM, whose role is to ensure that the carbon price of products imported to the EU is equivalent to the carbon price of domestic production, thus helping to avoid carbon leakage. The launch of the EU ETS2 widens the scope by including smaller and less energy-intensive industrial plants into the system. The ICMS is a long-term plan for handling inherent emissions, linked to the annual injection capacity target of at least 50 Mt CO<sub>2</sub> by 2030, as set in the NZIA. The switch to zero-carbon energy and feedstock sources in industry is supported on the EU level through numerous hydrogen-related initiatives following the implementation of the Hydrogen Strategy. Indirect measures are included in revision of the Renewable Energy Directive (RED III), which aims at accelerating the renewable energy and network deployment. However, their effectiveness will depend on national implementation.

**Areas of action:** The main focus in this area should be the careful implementation of adopted policies. It concerns both the joint EU initiatives (where the main challenge is the effective introduction of CBAM, see 4.13) as well as national legislation (with high-quality national planning and facilitation of infrastructure development, as well as national-level funding). More attention should be given to ensure the consistency and quality of national strategies related to industrial transition, as well as to the electrification of industry, particularly through stronger incentives for heat pumps. The idea of providing EU-level funding for investments in the industrial transition needs to be revisited.

## Enabler 1: Ensuring availability of zero-carbon energy and feedstock carriers and infrastructure

**Past progress:** Industrial enterprises need access to sufficient amounts of zero-carbon energy and feedstock carriers and related infrastructure to reduce their GHG emissions. The transition in this sector will require mostly carriers such as electricity, ambient heat, biomass, hydrogen, and synthetic fuels (Tsiropoulos et al., 2020b). Infrastructural needs also include CO<sub>2</sub> transport networks and storage, as some of the industry branches will need to rely on long-term geological storage of CO<sub>2</sub> to drive emissions down. Just as in last year's assessment, there was still not enough data available to assess developments regarding this enabler in a comprehensive way. The indicator switch from 'CO<sub>2</sub> injection capacity' to 'amount of CO<sub>2</sub> captured' reflects which measure is preferred to more accurately track the scale of deployment of carbon capture technologies.

### Indicators:

- Annual production of renewable hydrogen for industrial use
- Amount of CO<sub>2</sub> captured

**Policy context:** There has been signs of policy progress mainly through the NZIA, which focuses on scaling up domestic manufacturing capacity of strategic clean technologies through lowering the administrative burden and facilitating permitting, enhancing access to relevant data and knowledge, facilitating access to markets, and supporting innovation through regulatory sandboxes. The new Industrial Carbon Management Strategy (ICMS) (EC, 2024c) sets three different stages of developing industrial carbon management, initiates preparatory work on a CO<sub>2</sub> transport regulatory package, and supports the uptake of CCS (Carbon Capture and Storage) and CCU (Carbon Capture and Utilization) technologies. The ICMS does this through a platform for demand assessment and aggregation, the creation of an investment atlas of potential CO<sub>2</sub> storage sites, and by developing guidance for permitting processes for relevant projects. Policies related to CO<sub>2</sub> networks are also part of Trans-European Networks for Energy (TEN-E) Regulation. The support for hydrogen projects is available through the European Hydrogen Bank, launched in 2022. The Bank is a financing instrument, whose role is to accelerate private investments in hydrogen value chains and provide support for domestic production of renewable fuel of non-biological origin (RFNBO) hydrogen. Support for industrial decarbonisation in the coming years will also be coordinated through STEP. The Platform will, however, not provide new European-level funding. Projects in this area can benefit, depending on the degree of their innovativeness, from funding via Horizon Europe, the Innovation Fund, the Connecting Europe Facility (CEF) and the Modernisation Fund.

**Areas of action:** A key issue for the provision of zero-carbon energy sources and infrastructure is the effective implementation of existing policies and a follow-up on the ICMS. Improvement of NECPs seems crucial for facilitating the successful implementation and optimal distribution of the funds, as so far conclusions from ECNO (2024b) indicate that national strategies are currently not detailed and consistent enough. Another area of action is the creation of a comprehensive monitoring framework, including robust indicators in this area, which would enable tracking progress, and hence improve the quality of planning, policy design, and evaluation.

## Enabler 2: Boosting circular economy

**Past progress:** Increased circularity has the potential to contribute to reducing GHG emissions from industry in a cost-efficient way, as it implies lower demand for primary materials, and hence a decrease in upstream emissions and lower overall energy and feedstock input. However, in the five years through 2022, changes in the area of circular economy were progressing **too slowly** to meaningfully support reduction targets in the industrial sector. What is especially concerning is the prolonged stagnation of progress on circular material use, despite the target, outlined in the CEAP (EC, 2020f), of doubling it until 2030 relative to the 2020 level. In 2022, the indicator was equal to 11.5%, having been oscillating around this level since 2017 without forming a clear trend. Resource productivity increased in 2022 by a satisfactory 8% compared to 2021. This may reflect a slowdown in more resource-intensive branches of industry, which were a result of the fossil-fuel crisis. However, this latest change is still **too slow** to improve the trend's dynamics sufficiently to classify it as **on track**.

### Indicators:

- Circular material use rate
- Resource productivity

**Policy context:** The EU aims to transition to a more circular economy in order to achieve more sustainable economic growth and facilitate the transition to climate neutrality. Policy instruments, which are planned to be implemented to achieve this, are outlined in the CEAP. So far, the EU has formally adopted the Ecodesign for Sustainable Products Regulation (pending final approval), Empowering Consumers for the Green Transition Directive, Batteries and Waste Batteries Directive, Common Charger Directive, and Classification, Labelling, and Packaging of Chemicals Regulation. However, many legislative procedures are likely to face delays due to their more stringent environmental requirements, which need to be discussed by various stakeholder groups. In most directives and regulations, the requirements are less stringent at the end of negotiations compared to the first version published by the European Commission.

**Areas of action:** The main actions in the updated CEAP focus on engaging consumers in the transition towards a circular economy (CE), introducing sustainable products as the norm in the EU market, creating systemic frameworks for managing emissions, waste, resources, materials, and products in line with CE principles, and effectively implementing CE to strengthen decarbonisation efforts. Member States will likely face problems related to consumer engagement challenges, support for circular economy models, volatility in mandatory schemes, and technology gaps in targets. However, the adaptation of policy instruments and tools by Member States will determine the success or failure of the transition from linear to circular models.

## Enabler 3: Enhancing energy efficient industrial processes

**Past progress:** The latest trends point to a notable improvement of the energy efficiency of industrial processes, but the changes were still **too slow** in the period assessed. Recent positive developments have been triggered by economic consequences of the Russian large-scale invasion of Ukraine, leading to higher energy prices and increased volatility in 2022. As a result, the final energy consumption in industry dropped to the lowest value since 1990, when the data first started to be collected – notably also below the 2020 level, when industrial activity plunged due to the COVID-19 crisis. The continuation of post-pandemic recovery efforts in industry was associated with higher output in 2022 (Eurostat, 2024l), leading to an improvement of the energy intensity of the output. The positive developments with respect to energy efficiency are likely to prove durable if industrial enterprises continue to diversify their energy mix to avoid dependency on imported fossil fuels.

### Indicators:

- Final energy consumption in industry
- Energy intensity of output

**Policy context:** The EU ETS is the main political instrument driving progress on the energy efficiency of industrial processes, as it increases the relative costs of using energy from fossil fuels in the plants covered by the scheme both directly (large emitters) and indirectly (via electricity consumption). The revision of the EU ETS, which was adopted in 2023 as part of the Fit For 55 package, will provide further stimulus by reducing the supply of allowances to reach alignment with the new 2030 climate target. The planned phase-out of free allocation of the EU ETS allowances in the period of 2026–2034, which will be introduced in parallel to CBAM, constitutes another stimulus for increased efforts related to energy efficiency in industry. The extension of emissions trading to industrial plants via ETS2, which was previously not covered by EU ETS, will provide incentives for smaller and less energy-intensive industrial plants to further optimise their energy use. Moreover, strengthening of Energy Efficiency Directive in 2023, adopted as part of the REPowerEU plan, set a stricter energy efficiency target of reducing final energy consumption by at least 11.7% compared to projections of the expected energy use for 2030, with an associated framework for national-level actions.

**Areas of action:** Increased electrification, especially with regard to low temperature heat processes, can be an effective avenue for enhancing overall energy efficiency. To unlock this source of energy savings, a clear industrial electrification strategy and dedicated support is needed, especially focused on removing barriers to deployment – both cost-related and non-cost-related (such as administrative and permitting burdens). To manage financial limitations to investment, additional resources should be provided in this area – either within existing frameworks (e.g. Innovation Fund) or by launching new funding tools.



# Buildings



## Far too slow

Buildings facilitate activities essential for human life and society. Optimising building services, renovating them, and transitioning to renewable technologies are crucial.

## 4.4 Buildings



**Past progress:** Progress towards climate neutrality in the buildings sector was **far too slow** – the same as last year’s assessment. This is primarily due to operational emissions from buildings, which are not declining rapidly enough to reach the EU’s 2030 targets. Current renovation rates, especially for deep renovation, are insufficient. In the assessed period, heating energy demand was only slightly decreasing but not sufficiently to reach EU targets for 2030. Additionally, the current transition to renewable energy in buildings is not sufficient to significantly lower emissions. Despite a notable increase in heat pump sales in the EU since 2016, this trend decreased in 2023. While in principle, a fair reduction in the average space per person is the most efficient way to lower emissions, the recent trend shows an increase.

**Policy context:** In 2023, there were significant changes in policy with revisions to three main directives: Energy Performance of Buildings Directive (EPBD), Energy Efficiency Directive (EED), Renewable Energy Directive (RED). While most of the indicators in this assessment are covered by these directives, it is too early to gauge their impact. The latest version of the EPBD is a compromise: it delays and reduces the ambition for Zero-Emission Buildings (ZEB) and Minimum Energy Performance Standards (MEPS) compared to the EC proposal. However, it still outlines a clear plan for non-residential buildings with MEPS and establishes an energy efficiency trajectory for residential buildings. It also includes provisions to simplify the energy renovation process, e.g., by defining deep renovations and improving access to information and financing renovations.

**Areas of action:** Action to reduce operational emissions is insufficient and should primarily focus on shifting to renewable energy, particularly through the accelerated deployment of heat pumps. For renovations, an enforcement system should accompany MEPS to monitor their deployment and impacts effectively. Additionally, providing grants through public finance would address the financial barriers faced by low-income and vulnerable households, as well as rental households. Thirdly, establishing national databases for building energy performance is a crucial step to address the lack of centralised, comparable, and up-to-date data. Finally, a reduction target should be set for all embodied emissions, including renovations, such as broadening the definition of ZEB to encompass lifecycle carbon.

**Table 10: Progress in buildings towards the objective and enablers**

OBJECTIVE	ENABLERS		
Reducing buildings emissions and limiting material demand 	Reducing demand for heating and cooling 	Facilitate the renovation of buildings 	Accelerate the technology switch 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. [See Table 35](#) for further information.

Source: ©ECNO.

Table 11: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change		
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.	
<b>OBJECTIVE: Reducing buildings emissions and limiting material demand</b>							
		GHG emissions from buildings [Mt CO <sub>2</sub> e]	2017–2022 (EEA, 2023b)	-1.8% per year	-9.3 Mt CO <sub>2</sub> e per year	216 Mt in 2030 (EC, 2020d)	-33.2 Mt per year (2023–2030) → 3.6 times faster
		Demand of cement or concrete blocks and bricks [M tons]	2017–2022 (Eurostat, 2023j)	7.2% per year	4.1 Mt per year	n/a	n/a
<b>ENABLER 1: Reducing demand for heating and cooling services</b>							
		Average space per capita [m <sup>2</sup> /capita]	2015–2020 (EC, 2023i)	1.1% per year	0.8 m <sup>2</sup> /capita per year	n/a	n/a
		Demand for heating and cooling [kWh/m <sup>2</sup> ]	2010–2015 (Mantzios et al., 2018)	-1.3% per year	-1.5 kWh/m <sup>2</sup> per year	87.2 kWh/m <sup>2</sup> by 2030 (EC, 2020d)	-1.3 kWh/m <sup>2</sup> per year → on track based on old data
		Demand for heating of residential buildings [kWh/m <sup>2</sup> ]	2016–2021 (ODYSSEE, 2024)	-0.3% per year	-0.3 kWh/m <sup>2</sup> per year	96.1 kWh/m <sup>2</sup> by 2030 (EC, 2020d)	-1.4 kWh/m <sup>2</sup> per year → 4.7 times faster
<b>ENABLER 2: Facilitating the renovation of buildings</b>							
		Investments for energy renovation [billion EUR]	2011–2016 (EC, 2023i)	5% per year	13.2 billion EUR per year	n/a	n/a
		Average renovation rate [%]	2016	n/a	n/a	double between 2020 and 2030 (EC, 2020d)	n/a
		Deep renovation rate of residential buildings [%]	2016	n/a	n/a	n/a	n/a
		Deep renovation rate of non-residential buildings [%]	2016 (DG Energy et al., 2019)	n/a	n/a	n/a	n/a
<b>ENABLER 3: Accelerating the technology switch</b>							
		Share of renewable energy in heating and cooling [%]	2017–2022 (Eurostat, 2023i)	3.2% per year	0.7%-points per year	49%-points in 2030 (RED III)	3.0 %-points per year (2022–2030) → 4 times faster
		Heat pump sales [Million units]	2016–2021 (EHPA, 2024)	17.2% per year	0.22 M units per year	4.7 M units in 2030 (EC, 2024m)	0.28 M units per year → 1.3 times faster

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Reducing buildings emissions and limiting material demand

**Past progress:** The EU fell short of its target to cut buildings' GHG by 60% by 2030 compared to 2015 levels (EC, 2020d). To meet the target, emissions reductions in the buildings sector need to more than triple from 2023 to 2030, reaching 33 Mt CO<sub>2e</sub> per year compared to 9 Mt CO<sub>2e</sub> per year between 2017–2022. Constructing buildings and related works in the EU accounted for 9.4% of all domestic GHG emissions in 2019 (EC, 2021p). While there is no EU target, improved material efficiency could potentially reduce 80% of these emissions (EC, 2021p). However, the demand for cement or concrete blocks and bricks, essential for constructing new buildings, increased by an average of 7% annually between 2017 and 2022, indicating a trend in the **wrong direction**.

### Indicators:

- GHG emissions from building
- Demand of cement or concrete blocks and bricks

**Policy context:** The main EU policies relevant for these objectives are the Energy Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED). Both were revised in 2023, with only the EED having been formally adopted. The EPBD is the main legislation for the building sector. Detailed insights into the revised EPBD, particularly concerning renovation obligations, are outlined in enablers 1 and 2. Additionally, the REPowerEU initiative aims to install 30 million hydronic heat pumps by 2030, compared to 2020 levels (EC, 2024p). The subsequent sections outline the key elements of the revised directives and their associated goals. The revised EPBD includes a requirement to calculate and disclose Whole Life Carbon emissions for new buildings larger than 1000 m<sup>2</sup> by 2028, and for all new buildings by 2030. Member States (MS) are obligated to publish and notify the Commission of a roadmap by January 2027, outlining the implementation of limit values on the total cumulative life cycle of all new buildings. These limit values should set targets for new buildings from 2030, following a progressive downward trend.

**Areas of action:** This section focuses on the policy gaps in embodied emissions from buildings, while operational emissions are covered in the following sections. Deploying low-carbon measures in renovation and new buildings can prevent a sharp increase in embodied emissions by 2050, while maintaining an annual renovation rate of at least 3% (Le Den et al., 2023). While progress is being made in assessing the overall carbon impact of new buildings through the EPBD review, there is still no equivalent measure for the renovation of existing buildings. In its next revision in 2027, the EPBD should be reinforced with additional actions, including broadening the definition of zero-emission buildings to encompass lifecycle carbon (BPIE, 2022). In addition, to prevent deep renovations from causing high emissions, a cap on the embodied emissions associated with renovations should be set, as it is done in Nordic countries for constructing new buildings (Nordic Sustainable Construction, 2024). This would complement renovation goals, explained in the following section. Finally, alternative methods for reducing material demand before usage include urban and territorial spatial planning (ESABCC, 2024).

## Enabler 1: Reducing demand for heating and cooling

**Past progress:** The trend for reducing the surface area of buildings, which reduces energy demand, was heading in the **wrong direction** between 2015 and 2020 with an annual increase of 0.8 m<sup>2</sup>/capita in average space per person (Table 11). Thermal renovation and electrification, the two other main ways of reducing energy demand, are specifically covered by enablers 2 and 3. Between 2010 and 2015, there was an annual decrease of 1.5 kWh/m<sup>2</sup> in energy consumption for heating and cooling. More recently, and on a smaller scope that only includes household heating, the annual decrease fell to just 0.3 kWh/m<sup>2</sup> per year between 2016 and 2021. This indicates insufficient progress towards achieving the Renovation Wave target of an 18% reduction by 2030 compared to 2015 levels (EC, 2020d). However, the COVID-19 pandemic restrictions could have affected this indicator in 2020 and 2021. With individuals spending more time at home, it might have resulted in a less significant decrease in the trend (BPIE, 2023a).

### Indicators:

- Average space per capita
- Demand for heating and cooling
- Demand for heating of residential buildings

**Policy context:** The Renovation Wave originated in the revision of the EPBD, approved in December 2023 and adopted in April 2024. The revised EPBD focuses largely on renovation and new buildings' efficiency. It aims to transform the existing building stock into zero-emission buildings (ZEB). By 2030, the directive sets three intermediary goals: firstly, all new buildings should be ZEBs from 2030. Secondly, new buildings owned by public authorities should be ZEBs from 2028. Thirdly, for residential buildings, MS need to establish their own national plans to decrease the overall average primary energy consumption of residential buildings by at least 16% by 2030, compared to 2020, and 20-22% by 2035. MS have the flexibility to employ methods beyond Minimum Energy Performance Standards (MEPS) to achieve this goal, while ensuring that at least 55% of the reduction comes from renovating the least efficient buildings. For non-residential buildings, MS must enforce MEPS, aiming to renovate the 16% worst-performing buildings by 2030. This target will be increased to 26% by 2033. Regarding the last objective on non-residential buildings, particularly on public buildings, the revised EED sets a more ambitious target of achieving an annual renovation rate of 3% and reaching the new ZEB standard.

**Areas of action:** Progress could be made by providing more clear guidance on how to reduce the floor area through urban or spatial planning. Secondly, effective compliance support and an enforcement system should accompany MEPS to monitor and track their deployment and impacts (BPIE, 2023a). For the MEPS scheme to be effective, accessible, and affordable, it should be integrated into a comprehensive ecosystem of supporting policy instruments tailored to the diverse needs of various target groups (BPIE, 2023b).

## Enabler 2: Facilitating the renovation of buildings

**Past progress:** Data on EU renovations are sparse, hindering implementation tracking. Only outdated data on renovation rates and depth from 2016 exists, and information on average annual energy-related renovation investments is equally outdated (see [Table 11](#)), despite the EU initiative on the Building Stock Observatory. The renovation rate between 2012 and 2016 was around 1% per year and needs to double by 2030 to reach the target of 2% (EC, 2020a). In 2016, shallow retrofits dominated, and deep renovations made up only roughly one fifth of all EU renovations. Renovation rates of 0.2% for residential and 0.3% for non-residential buildings indicate a lack of common deep renovation practices. Since the publication of these figures, the revised EPBD has refined the renovation level needed to achieve deep renovation. Annual investments in renovation increased by 5% per year between 2012 and 2016, or 13 billion EUR per year. Despite the lack of recent data, renovation rates and depth are considered **far too slow** to achieve the goals of the Renovation Wave (BPIE, 2021), as are investments (Calipel et al., 2024).

### Indicators:

- Investments for energy renovation
- Average renovation rate
- Deep renovation rate of residential buildings
- Deep renovation rate of non-residential buildings

**Policy context:** EPBD and MEPS were introduced in the previous section. The EPBD defines ‘deep renovations’ as upgrades that turn buildings into nearly zero-energy buildings (NZEB) until 2030, and then into zero-emission buildings (ZEB) starting from 2030. While these tools aim to enhance renovation efforts, it is too early to gauge their effectiveness. Regarding investment in renovation, MS are tasked with providing financing, setup support measures, and other tools to overcome market barriers towards achieving the ZEB target by 2050. Meanwhile, the Commission will enact a Delegated Act in 2025 aimed at incentivising financial institutions to boost funding for renovations. In the revised EED, the Commission will provide guidance for MS and market actors on how to unlock private investment by the end of 2024. Finally, the creation of the Social Climate Fund (SCF) under the EU ETS Regulation will allocate funds to MS, particularly targeting vulnerable groups in the construction industry and other sectors. In addition, ETS 2 will include CO<sub>2</sub> emissions from fuel combustion in buildings. The carbon price under ETS 2 will likely encourage investments in renovations. Yet, the effects of these measures on renovation investment remain uncertain.

**Areas of action:** National databases for building energy performance should be established and centralised to address the lack of up-to date data at the EU level. Skills training should also be supported at the EU level to enable the creation of much-needed jobs (ESABCC, 2024). The new ETS 2 for energy use in buildings will aid energy retrofits, but additional measures are needed to address barriers related to distribution, organisation, administrative capacity, investment, and data that extend beyond inadequate price signals (ESABCC, 2024). Finally, public finance should provide grants to address the financial barriers faced by low-income and vulnerable households, as well as rental households. Strategies to improve the use of existing funding programmes should be put in place (BPIE, 2023a).

## Enabler 3: Accelerate the technology switch

**Past progress:** Progress in decarbonising heat supply was sluggish, with data indicating an annual increase of renewable energy in heating and cooling of only 0.7% between 2017 and 2022, mostly due to the contribution of biomass and heat pumps (EC, 2024o). This is falling far too short of the required pace to reach the goals of 49% by 2030, as set in the RED III Directive, and complete phase-out of fossil fuels by 2040. To meet the renewable energy target of 49% by 2030, the annual increase between 2021 and 2030 must accelerate to 3.0%, which is 4 times the current rate. Notably, the sale of heat pumps saw significant growth, averaging 17% per year between 2016 and 2021, resulting in an average annual increase of 0.2 million in sales of units. Recent data however suggest that this trend decreased in 2023 (EHPA, 2024). An accelerated trajectory is essential to achieve the target of a 60 million heat pump stock by 2030, as suggested by the impact assessment on the 2040 climate target (EC, 2024m). Under certain assumptions, this target is equivalent to an annual sale of 4.7 million per year by 2030.

### Indicators:

- Share of renewable energy in heating and cooling
- Heat pump sales

**Policy context:** To increase the share of renewables in buildings by 2030, four main strategies have been outlined: firstly, the revised EPBD (EC, 2021i) establishes the ambitious target of phasing out the use of fossil fuels for heating and air conditioning systems in buildings by 2040. To reach this target, MS shall not provide any financial incentives for the installation of fossil-fuel based stand-alone boilers from January 2025. Secondly, the EU Heat Pump Action Plan, a non-legislative initiative by the Commission, seeks a substantial boost in heat pump deployment, projecting over 30 million more hydronic units by 2030 compared to 2020 (EC, 2024p). Thirdly, the Ecodesign Regulation proposed by the EC (2022o) aims for an EU-wide cessation of the sale of fossil-fuel boilers for space and water heating starting from 2029. Finally, under the revised EPBD, Member States must guarantee the installation of suitable solar energy systems on buildings, if feasible both technically and financially. This requirement covers non-residential and new residential buildings, with deadlines ranging from 2026 to 2029, depending on the building type and size.

**Areas of action:** Insufficiently robust EU standards for heating equipment are causing only small improvements in reducing fossil-fuel emissions and creating lock-in effects. This partly explains why EU policies have not been very successful in shifting away from fossil fuels (ESABCC, 2024). Secondly, the decline in heat pump sales in 2023 was caused by lower gas prices and decreased government support (EHPA, 2024). Publishing the EU Heat Pump Action Plan could help to turn this trend around. In addition, new policies could increase the uptake of heat pumps, e.g., through Ecodesign policies to phase out the sale of fossil-fuel equipment. Finally a clean heat market mechanism, as the UK is employing (DESNZ, 2023), could drive down prices for clean heat technologies and decrease fossil-fuel subsidies.



# Agrifood



## Far too slow

Agrifood refers to all stages of the agricultural supply chain, from food production to consumption to disposal, while also considering aspects of land use and the production of agricultural inputs.

## 4.5 Agrifood



**Past progress:** Progress towards climate neutrality was **far too slow** in the EU’s agrifood sector in the assessed period. The outlook for overall GHG emissions reduction slightly improved since last year’s assessment, but reductions were still not occurring fast enough; in particular, reductions in downstream sectoral emissions need acceleration. Cattle meat consumption levels remained too high. The EU will likely fall short of its 2030 targets for nitrogen fertiliser use, organic farming expansion, and food waste reduction. The manure management emissions intensity of cattle and total livestock numbers were both headed in the **wrong direction**.

**Policy context:** Since 2020, the EU’s guiding framework for mitigating emissions from the agrifood system is the Farm to Fork Strategy (F2F). The F2F Strategy outlines a set of largely voluntary measures that leverage the link between human health and environmental sustainability. Revised in 2021, the Common Agricultural Policy (CAP) is the EU’s principal financing mechanism for the agricultural sector. The revision claims to channel 40% of its budget towards providing ‘climate-relevant’ support (EC, 2021n), but a serious reduction in emissions is unlikely (ESABCC, 2024); especially given that, following union-wide protests from farmers, the EC proposed loosening key environmental regulations under the CAP (Ca-sert, 2024) and removed the mention of a 25% reduction target for non-CO<sub>2</sub> emissions from the agrifood sector from its 2040 target update (Arboleas, 2024).

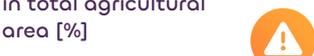
**Areas of action:** The EU’s vision for the agrifood sector, as laid out in the F2F Strategy, has not been supported by sufficient, compulsory policy: many of the proposed policy actions—notably, the legislative framework for sustainable food systems—have not materialised (EPRS, 2024). The CAP’s funding structure could encourage a sustainable, increasingly plant-based food system instead of incentivising emissions-intensive, animal-based agriculture. As the recent protests from European farmers highlight, this shift will require careful planning and integration within a long-term, just transition strategy (Schröder & Benton, 2024). Critically, supply-side measures should be complemented by policies on demand. The EU could also clarify inconsistencies in its signals regarding food waste reduction targets.

**Table 12: Progress in agrifood towards the objective and enablers**

OBJECTIVE	ENABLERS		
Minimising agrifood emissions and shifting diets 	Reducing fertiliser use and cropland-related emissions 	Making livestock production more sustainable 	Reducing food waste and end-of-supply chain emissions 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.  
 Source: ©ECNO.

Table 13: Details on indicators' past progress and required change

2023 ▼	2024 ▶	Historical data			Required change		
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.	
<b>OBJECTIVE: Minimising agrifood emissions and shifting diets</b>							
		Agricultural emissions [MtCO <sub>2</sub> e]	2017–2022 (EEA, 2024b)	- 0.8% per year	-3.0 MtCO <sub>2</sub> e per year	254 MtCO <sub>2</sub> e in 2050 (EC, 2018)	-4.2 MtCO <sub>2</sub> e per year (2023–2050) → 1.4 times faster
		Cattle meat consumption [kg/capita]	2017–2022 (DG AGRI, 2023)	-0.7% per year	-0.1 kg/capita per year	34% reduction by 2050 relative to 2013 (EC, 2018)	-0.1 kg/capita per year (2023–2050) → 1.6 times faster
<b>ENABLER 1: Reducing fertiliser use and cropland-related emissions</b>							
		Nitrogen fertiliser use [kg N/ha]	2016–2021 (EU CRF, 2023)	-1.0% per year	-0.8 kg N/ha per year	20% reduction by 2030 vs. 2018 (EC, 2020b)	-1.5 kg N/ha per year (2022–2030) → 1.8 times faster
		Share of organic farming in total agricultural area [%]	2017–2022 (FiBL, 2024)	6.6% per year	0.6%-points per year	25% in 2030 (EC, 2020b)	1.8%-points per year (2021–2030) → 3.2 times faster
<b>ENABLER 2: Making livestock production more sustainable</b>							
		Manure management emissions intensity of cattle [tCO <sub>2</sub> e/cattle]	2016–2021 (EEA, 2023b)	0.3% per year	0.001 tCO <sub>2</sub> e/cattle per year	n/a	n/a
		Livestock numbers [million head]	2016–2021 (EU CRF, 2023)	0.2% per year	3.5 million head per year	n/a	n/a
<b>ENABLER 3: Reducing food waste and end-of-supply chain emissions</b>							
		Volume of food waste [kg/capita]	2020–2021 (Eurostat, 2023b)	n/a	n/a	50% reduction by 2030 (EC, 2020b)	n/a
		Emissions from food processing, transport, and packaging [MtCO <sub>2</sub> e]	2016–2021 (FAO, 2023)	-1.6% per year	-3.8 MtCO <sub>2</sub> e per year	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Minimising agrifood emissions and shifting diets

**Past progress:** Over the period assessed, progress towards minimising agrifood emissions and shifting diets was **too slow** to reach climate neutrality by 2050. Reductions in agrifood emissions, which include on-farm emissions, but exclude energy use and LULUCF emissions, were **too slow** to reach the EU's 2050 emission target level of 245 MtCO<sub>2</sub>e (EC, 2018). Compared to last year's progress assessment, the rate of emissions reduction increased but still needs to be further accelerated. The decrease in emissions may be attributed to decreased fertiliser use (EEA, 2023b) caused by the energy crisis (FE, 2022). The status of shifting towards less emissions-intensive diets remained **too slow** and was incompatible with the EU's target of decreasing cattle meat consumption by 34% in 2050 compared to 2013 consumption levels (EC, 2018).

### Indicators:

- Agricultural emissions
- Cattle meat consumption

**Policy context:** The 2020 F2F Strategy and the 2021 CAP revision are the EU's principal tools for reducing emissions and advancing sustainability in the agrifood sector (ESABCC, 2024). The F2F Strategy established key targets to reduce agricultural emissions and introduced 27 relevant, but largely discretionary, measures to create a more sustainable food system. Six of these measures directly promote a shift to more sustainable, healthier diets. The CAP—which is the EU's single largest expenditure (Clark, 2024)—increasingly considers the climate footprint of the agricultural sector, but has been unable to mitigate agricultural emissions: between 2014 and 2020, the CAP's allocation of EUR 100 billion towards climate change mitigation and adaptation did not reduce emissions (ECA, 2021). The revised CAP requires Member States (MS) to draft CAP Strategic Plans (CSPs), which largely shifts responsibility for climate action to MS (ESABCC, 2024). In 2022, the EU proposed amending the Industrial Emissions Directive (IED) (EC, 2022k) to more stringently regulate emissions from large pig and poultry farms (Haahr, 2024).

**Areas of action:** The EU could, as recognised by the majority of EU experts in the IEEP's 2023 European Green Deal Barometer (IEEP, 2023), use the CAP to financially encourage low-emission agriculture (Björkbom, 2023). The CAP's current subsidy structure does not financially incentivise a phase-out of emissions-intensive, industrialised agriculture (EEA, 2022c), but rather reinforces harmful, consolidated farming practices (ECA, 2021). Developing and adopting the F2F Strategy's proposals for setting minimum mandatory criteria for sustainable food procurement (ESABCC, 2024), creating a sustainability labelling framework (Katsarova, 2024a), and harmonising mandatory front-of-pack nutrition labelling (Katsarova, 2024b) would support healthier, plant-based diets. In the F2F Strategy, the EU acknowledges the potential for demand-side tax incentives to create a more sustainable food system but does not introduce any explicit price-based policies in the strategy's action plan. The EU could consider financial policies, such as emission pricing, to complement improved labelling, which is unlikely to facilitate the necessary shift in diets on its own (ESABCC, 2024). The IED could be expanded to include cattle farms; a critical omission as cattle are the most GHG-emitting livestock species (Wisser et al., 2023).

## Enabler 1: Reducing fertiliser use and cropland-related emissions

**Past progress:** Progress towards reducing fertiliser use and cropland-related emissions—as measured by the level of nitrogen fertiliser consumption and the share of organic farming area in the EU—was **too slow** to meet the EU’s 2050 target for climate neutrality. Although the use of nitrogen fertiliser decreased since 2017 (EU CRF, 2023) and is expected to decrease more rapidly over the next decade (FE, 2022), the reduction rate was **too slow** to meet the reduction target of 20% by 2030 relative to 2018. Nitrogen fertiliser consumption must decrease 1.8 times faster every year, or by 1.5kg N/ha per year, to reach the EU’s 2030 target. The EU seeks to substantially increase the application of organic farming: by 2030, 25% of the EU’s total agricultural area should be farmed organically. However, the rate of progress towards this 2030 target was **far too slow**: at the current rate, organic farming will only account for roughly 15% of the EU’s entire agricultural area in 2030. The rate needs to increase by 3.2 times to remain compatible with the 2050 climate neutrality target.

### Indicators:

- Nitrogen fertiliser use
- Share of organic farming in total agricultural area

**Policy context:** The EU’s 2020 F2F Strategy is the first step towards creating a more sustainable and resilient food system (ESABCC, 2024) by setting explicit targets for reducing nitrogen fertiliser use and expanding organic farming areas in the EU. The CAP currently financially supports nearly two-thirds of the total organic farming area in the EU (EC, 2023z). Historically, the CAP has also provided minimal financial support for the methods to reduce nitrogen fertiliser dependency, such as the planting of forage legumes on grassland and the application of nitrification and urease inhibitors in soils (ECA, 2021). In addition, some MS national plans include measures that may reduce domestic fertiliser use (ESABCC, 2024). Generally, efforts to reduce fertiliser use are determined by MS in their CSPs. In 2023, the EC reviewed submitted CSPs and found limited support for fertiliser use reduction: only 15% of the EU’s agricultural land is cultivated with moderated nitrogen fertiliser application (EC, 2023ao).

**Areas of action:** Although the F2F Strategy sets targets for reducing nitrogen fertiliser use and scaling organic farming, the strategy does not introduce compulsory, tangible policy measures to support the targets. Progress could furthermore be made by increasing CAP funding for organic farming, which simultaneously sequesters more CO<sub>2</sub> and releases fewer N<sub>2</sub>O emissions than non-organic farming (Brook, 2022). The CAP could also expand its financial support for strategies to reduce fertiliser employment for non-organic farms. Additionally, bolstering support for digitalised, GPS-enabled precision farming could help mitigate emissions (Balafoutis et al., 2017) and improve the profitability of crop and livestock production (Boehlje, 2021).

## Enabler 2: Making livestock production more sustainable

**Past progress:** Progress toward making livestock production more sustainable was headed in the **wrong direction** in the assessed period. Both indicators for this enabler—manure management emissions intensity of cattle and overall livestock populations—should decrease to minimise the sectoral GHG emissions. Instead, the manure management emissions intensity of cattle, which are the largest source of manure management emissions, has remained nearly constant at 0.38 tCO<sub>2e</sub> per cattle for the past 20 years. Livestock numbers, driven by growth in poultry farming across the EU (ECA, 2021), steadily increased by 0.2% per year between 2016 and 2021.

### Indicators:

- Manure management emissions intensity of cattle
- Livestock numbers

**Policy context:** Even though livestock production accounts for up to 86% of the EU's agricultural GHG emissions (Peyruad & MacLeod, 2020), the EU has not set explicit targets for or adopted legislation to manage livestock systems and the associated emissions. Although not officially acknowledged by the EU, reaching climate neutrality will likely require significant reductions in the emissions rates per livestock unit, as well as reductions in overall livestock numbers (Buckwell & Nadeu, 2018). Reducing emissions per livestock head demands caution: managing emissions from enteric fermentation may lead to a shift away from open-pasture farming to energy- and emissions-intensive, consolidated, industrialised farming, which is neither conducive to animal welfare nor emissions reduction. Other technical and genetic interventions, such as chemically synthesised inhibitors, have the potential to reduce emissions per livestock head, but require significantly more research and development (IPCC, 2022a). Livestock emissions can more simply be reduced by decreasing overall livestock populations and by improving manure management.

**Areas of action:** To make livestock production more sustainable, the EU could increase financial support for manure management strategies and implement policies to reduce overall livestock numbers. Slurry acidification, manure cooling, impermeable covers, and manure-derived biogas production are demonstrated means for reducing manure-induced emissions, but few farms receive CAP funding to apply these measures (ECA, 2021). Reducing the total number of livestock offsets the need to reduce emissions per livestock animal. A reduction in livestock numbers would directly reduce emissions from livestock and indirectly reduce emissions from feed production (ESABCC, 2024); EU soy feed imports are responsible for substantial emissions from land uses changes in exporting countries in Latin America (Rajão et al., 2020). Decreasing the supply of livestock should be complemented by a decrease in the demand for animal-based products to ensure that livestock production is not simply displaced abroad. Plant-based foods, which, even when highly processed (Detzel et al., 2021), have significantly lower GHG emissions per kilogram of protein than animal-based foods (Searchinger et al., 2019), must become readily and affordably available. Reducing the cost and increasing public awareness of plant-based foods can augment the consumption of healthier, more sustainable diets.

## Enabler 3: Reducing food waste and end-of-supply chain emissions

**Past progress:** Progress toward reducing food waste headed in the **wrong direction** between 2020 and 2021 (the latest available data), while progress towards reducing end-of-supply chain emissions in the EU was **far too slow** to reach climate neutrality by 2050. The EU generated nearly 131 kg of food waste per capita in 2021 (Eurostat, 2023b). End-of-supply chain emissions include the emissions from food processing, transport, and packaging. Emissions from food processing, transport, and packaging have decreased since the early 2000s; between 2016 and 2021, the reduction rate was 1.6% per year (FAO, 2023). Although headed in the right direction, reductions must be accelerated to remain aligned with the 2050 climate neutrality target.

### Indicators:

- Volume of food waste
- Emissions from food processing, transport, and packaging

**Policy context:** Reducing food waste is a key objective of the F2F Strategy. In the strategy, the EU commits to halving per capita food waste at the retail and consumer level by 2030. In 2023, the EC proposed revising the 2018 Waste Framework Directive (WFD) (EC, 2023ab). The proposal sets a 10% reduction target for food waste from processing and manufacturing and a 30% reduction target for food waste generated by households and retail, distribution, restaurant, and food services. The F2F Strategy also committed to revising the rules on date marking—the ‘use by’ and ‘best before’ labels—on food products sold in the EU in 2023. Although the EU intended to release the revised rules at the end of 2022, the rules have not yet been adopted. Generally, downstream emissions are not considered as part of overall agricultural emissions, but end-of-supply processes require significant energy inputs. The F2F Strategy does recognise the impact of food processing, packaging, and distribution but only establishes a voluntary code of conduct on responsible food business and marketing practices to address downstream emissions (EC, 2021e).

**Areas of action:** Further progress could be made by raising ambition and addressing inconsistencies in benchmarking for food waste reduction. The proposed amendment to the WFD does not set a benchmark for reducing food waste during primary agricultural production. Additionally, the food waste reduction targets that are established in the proposed WFD are less ambitious than the F2F Strategy’s 50% reduction target; likely resulting in the EU falling short of the 50% reduction target and, in doing so, failing to comply with the UN SDG Target 12.3 (ESABCC, 2024). A policy gap could be filled by setting a target for minimising downstream emissions in the agrifood sector. To address downstream emissions, the EU could escalate the voluntary, aspirational status of the guidelines on responsible food business and marketing practices (EC, 2021e) and mandate emission reduction from agrifood distributors and processors. Fulfilling its commitment to develop and adopt a proposal for date marking is a straightforward mechanism for the EU to reduce food waste by up to 10% (EC, 2018).



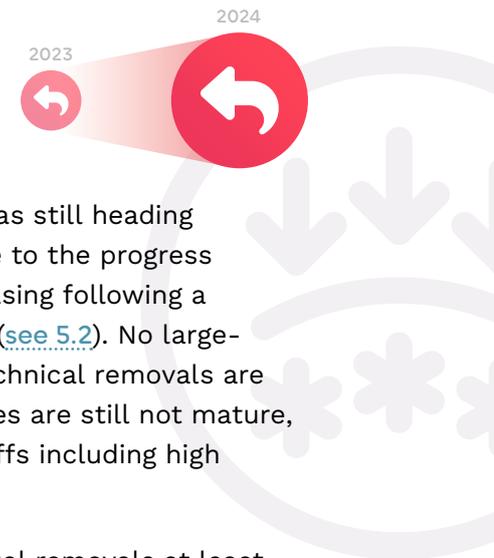
# Carbon Dioxide Removal



## Wrong direction

Carbon Dioxide Removal (CDR) is crucial to compensate for minimal residual emissions. It requires storing carbon in trees and soils and potentially using sustainable technical solutions in the future.

## 4.6 Carbon Dioxide Removal



**Past progress:** The development of Carbon Dioxide Removal (CDR) was still heading in the **wrong direction** in the period assessed, which means no change to the progress classification of last year. Net removals by natural sinks were decreasing following a declining rate of carbon stored in trees and unreliable data for soils (see 5.2). No large-scale technical removal plants have been deployed in the EU yet. Technical removals are increasingly subject to political attention; however, these technologies are still not mature, and are expensive and associated with substantial risks and trade-offs including high energy needs and pressure on land, water, and biodiversity.

**Policy context:** The EU Climate Law requires that by 2050 total annual removals at least exceed total emissions. The EU’s Land Use, Land-Use Change and Forestry (LULUCF) Regulation sets binding EU and national net removal targets for natural CDR. If finalised, the Nature Restoration Law’s binding restoration targets for natural sinks should improve forest and soil carbon sequestration and improve adaptability to climate change. The Common Agricultural Policy (CAP) provides financial incentives to sustainably manage forests and soils. The proposed soil and forest monitoring laws aim to improve data availability and quality. The Union certification framework for permanent carbon removals, carbon farming and carbon storage in products, the Certification Framework for Carbon Removals (CFCR), aims at encouraging uptake of both natural and technical CDR. The EC’s Industrial Carbon Management Strategy seeks to incentivise technical CDR investments, outlining actions that should complement other existing policies.

**Areas of action:** For natural CDR, there is an urgent need to increase the quantity and health of forest coverage, as well as ecosystem restoration and sustainable management of forests and soils. Good data is a prerequisite for any certification or assessment of implemented subsidies, and to monitor natural CDR. To secure the deployment of sustainable technical CDR post-2030, progress should be made towards R&D funding and a greater focus should be placed on full lifecycle impacts. A legal framework must ensure sustainability compliance and long-term financing options. Technical removals should be deployed with coordinated infrastructure provision powered by renewable energy.

**Table 14: Progress on carbon dioxide removals towards the objective and enablers**

OBJECTIVE	ENABLERS		
Enhancing natural sinks and delivering on technical removals 	Store more carbon in trees 	Storing more carbon in soils 	Applying technical removals sustainably 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 15: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change		
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.	
<b>OBJECTIVE: Enhancing natural sinks and delivering on technical removals</b>							
		Net removals from LULUCF [Mt CO <sub>2</sub> e]	2017–2022 (EEA, 2023b)	-1.4% per year	-3.4 Mt per year	310 Mt in 2030 (LULUCF Regulation)	8.3 Mt per year (2022–2030) → U-turn
		Net technical removals [Mt CO <sub>2</sub> e]	2018–2023 (CATF 2024)	0% per year	0 Mt per year	5 Mt in 2030 (EC, 2021r)	0.7 Mt per year (2022–2030) → n/a
<b>ENABLER 1: Storing more carbon in trees</b>							
		Growth in forest area [ha/yr]	2016–2021 (FAO 2024)	-3.7% per year	-7.200 ha per year	n/a	n/a
		Growth of carbon stock in forest land [Mt C/yr]	2016–2021 (FAO 2024)	-7.2% per year	-5.9 Mt C per year	n/a	n/a
<b>ENABLER 2: Storing more carbon in soils</b>							
		Soil organic carbon in arable land [g C/kg]	2009, 2018 (JRC ESDAC 2023)	n/a	n/a	n/a	n/a
		Net CO <sub>2</sub> emissions from crop-, grass-, and wetlands [Mt CO <sub>2</sub> ]	2016–2021 (EEA, 2023b)	-1.4% per year	-0.8 Mt CO <sub>2</sub> per year	n/a	n/a
<b>ENABLER 3: Applying technical removals sustainably</b>							
		Attention to technical CDR	n/a	n/a	n/a	n/a	n/a
		Costs of BECCS and DACCS [EUR/ t CO <sub>2</sub> e]	n/a	n/a	n/a	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Enhancing natural sinks and delivering on technical removals

**Past progress:** Even though net natural removals increased from 230 Mt CO<sub>2e</sub> in 2021 to 244 Mt CO<sub>2e</sub> in 2022, the 5-year trend line is still pointing in the **wrong direction** and signifies a declining sink. Removals must increase by 8.2 MtCO<sub>2e</sub> each year to reverse the trend and meet the 310 Mt CO<sub>2e</sub> net natural removal goal from the EU's LULUCF Regulation ([see Table 15](#)). In addition, the EU Climate Law requires that by 2050 total annual removals at least exceed total emissions. No technical options in the EU removed CO<sub>2</sub> from the atmosphere on a large scale in the period assessed, meaning that progress was **far too slow** to align with the EC's objective for technical CDR of at least 5 Mt CO<sub>2e</sub> in 2030 (EC, 2021r). However, the first Bioenergy with carbon capture and storage (BECCS) plants are under development in Sweden and Denmark (CATF, 2024).

### Indicators:

- Net removals from LULUCF
- Net technical removals

**Policy context:** The LULUCF Regulation sets EU- and Member State-specific natural CDR targets and provides accounting rules. Until 2026, it requires Member States to compensate emissions from land use with at least an equivalent quantity of removals; after that it enforces binding EU and national net removal targets. Still, insufficient attention has been paid to the declining land sink and its resilience. To reach LULUCF targets, it is still possible to trade removals between Member States and use surplus emissions allocations under the Effort Sharing Regulation. The CFCR (EC, 2022i) aims to incentivise removals through voluntary certification. The environmental integrity of this policy strongly depends on the additionality of certified removals and how it ensures long-term storage, the specific rules for which are still under development (Meyer-Ohlendorf et al., 2023). The proposed Net Zero Industry Act includes a target of 50 Mt CO<sub>2</sub> injection capacity per year by 2030 (EC, 2023e). The EC's Industrial Carbon Management Strategy (ICMS) promotes technical CDR by outlining upcoming initiatives to support the development of BECCS and Direct air carbon capture and storage (DACCS), with the aim of creating a single market for CO<sub>2</sub> (EC, 2024c).

**Areas of action:** The environmental integrity of natural and technical removals must be ensured to enhance carbon sequestration without negative side effects on biodiversity, land and resource use, especially associated with technical CDR (IPCC, 2022b, 2023). This focus on environmental integrity must be respected in policies for incentivising CDR under development, such as ensuring that the CFCR regulation rules deliver robust quantification, additionality, storage, monitoring, and liability. It is crucial to provide support, including public funding and guidance for sustainable natural and technical removal, particularly promoting the growth and restoration of forests and soil organic carbon, while ensuring climate adaptation ([see enabler 1](#) and [2](#)). Technical CDR must demonstrate its positive climate effect and that it does not lead to the use of unsustainable biomass or excessive energy ([see enabler 3](#)).

## Enabler 1: Storing more carbon in trees

**Past progress:** Forests are the key land solution for removing CO<sub>2</sub> from the atmosphere. But progress was still moving in the **wrong direction** in the assessed period. The carbon stock in forest land was increasing, but at a decreasing rate, from a 119 Mt increase in 2016 to a 73 Mt increase in 2021, with widely varying situations across Member States. The same applies to forest areas, which increased slightly from 181,600 ha in 2020 to 182,300 ha in 2021 but with a declining growth rate of 7,180 ha per year. This suggests a deteriorating ability of the EU's forests to sequester carbon due to temperature effects, natural disturbances worsened by climate change, harvesting practices, and mismanagement (ESABCC, 2024; Hyyrynen et al., 2023). At the same time, current data may not reflect the changes in forest carbon sequestration due to a lack of harmonised monitoring across the EU. For a more detailed analysis of this enabler [see also 5.2](#).

### Indicators:

- Growth in forest area
- Growth of carbon stock in forest land

**Policy context:** The LULUCF Regulation target for net removals and the Nature Restoration Law's goal to restore 20% of the EU's land areas by 2030 should improve forest carbon sequestration. The Forestry Strategy (EC, 2021g) lays out a plan to protect existing forests and provide financial incentives to increase forest cover, hence also CDR, including the goal to plant at least 3 billion trees by 2030. The CAP delivers subsidies for afforestation, reforestation, improved forest management, but also prevention of natural disasters and support for forest ecosystem services. The EC (2023c, 2023s, 2023u) provides voluntary guidelines and financial support for forestry measures but has few competencies for imposing binding obligations for carbon sequestration in tree biomass. In addition, the CFCR aims at incentivising forest planting by certifying carbon removals. The proposal for a Forestry Monitoring Law (EC, 2023x) aims to improve knowledge of forests, including by harmonising data from satellites and Member States. The Renewable Energy Directive (RED) strengthens sustainability criteria for forest biomass with new limits on its use for burning.

**Areas of action:** Forest restoration, afforestation, and sustainable forest management needs further promotion and support e.g., by providing guidance that also enhances biodiversity and the resilience of existing forests to climate change. The CAP could better facilitate sustainable forest practices through capacity building to help landowners implement appropriate measures (see e.g., Carbon Gap, 2022). Building on the '3 billion trees' initiative, the EU could consider using degraded or unused lands for the expansion of forests to new areas. In this context, it is important that EU policies on agriculture and bioenergy reflect the necessity to maintain and expand the area of forests for carbon sequestration (ESABCC, 2024). For any certification of forest carbon removals, such as under the CFCR, it is crucial that removals are of high integrity, ensuring quantification, additionality, long-term storage, and liability (Meyer-Ohlendorf et al., 2023). The EU's knowledge and database needs to be improved for forests based on a strong adoption and implementation of the proposed Forest Monitoring Law (EC, 2023ag).

## Enabler 2: Storing more carbon in soils

**Past progress:** Healthy soils provide several ecosystem services, including food production, water purification, carbon storage, but also offer potential for additional carbon sequestration (Rodrigues et al., 2021). However, soils are currently a net source of emissions as they are under significant pressures including land cover change, high-intensity land use, and erosion (EEA, 2023h). The concentration of organic carbon in arable land, including both organic soils such as peatlands and the more prevalent mineral soils, decreased slightly by 0.01% between 2009 and 2018 with no more recent data available. Linked to this, croplands, grasslands, and wetlands are still a net source of emissions (63 Mt CO<sub>2</sub>e), with roughly even shares from each respectively (23, 20, 21 Mt CO<sub>2</sub>e) (EEA, 2023b), despite wetlands representing only 4% of the land area (Eurostat, 2021). Although net emissions decreased by 1.4% per year between 2016 and 2021, these reductions are **far too slow** if soils are to positively contribute towards the LULUCF net removal target. It is important to note that data quality for soil carbon storage is poor due to measurement challenges (Bellassen et al., 2022).

### Indicators:

- Soil organic carbon in arable land
- Net CO<sub>2</sub> emissions from crop-, grass-, and wetlands

**Policy context:** The proposed EU Nature Restoration Law would establish legally binding objectives for Member States to restore agricultural organic soils, including introducing restoration measures on at least 30% of drained peatlands by 2030. The proposal for a Soil Monitoring Law (EC, 2023ad) will introduce a harmonised methodology and rules for monitoring. The CAP provides subsidies for improved soil management via the good agricultural and environmental conditions (GAEC) standard, the ‘eco-schemes’, and the voluntary agri-environmental-climate measures (EC, 2024n). However, some measures within the CAP indirectly degrade soils by promoting intensive farming practices (Carbon Gap, 2023a).

**Areas of action:** Carbon stored in wetlands, croplands, and grasslands needs to be preserved and restored. Additional support and guidance should be provided to promote the regeneration of soil health and carbon sequestration, also to ensure resilience of ecosystems. The CAP should be improved with stricter conditionality requirements and ‘eco-scheme’ and agri-environmental-climate incentives that result in increased removals (ECA, 2021; ESABCC, 2024). The inherent risk of reversals of soil organic carbon needs to be acknowledged and a holistic approach to addressing the multiple ecosystem services provided by soils should be taken. It should be a priority to promote the fast adoption and implementation of the Soil Monitoring Law proposal, establishing the knowledge base and ensuring easily accessible and regularly updated data. It is crucial that any certification of soil carbon removals is based on a solid database to ensure ‘real’ removals.

## Enabler 3: Applying technical removals sustainably

**Past progress:** Data is limited for checking progress towards enabling technical removals. Yet, technical CDR is increasingly receiving political attention to achieve long-term targets and net-negative emissions thereafter (EC, 2024b). However, it is important to acknowledge the risks and trade-offs with its upscaling regarding high energy needs and pressure on land, water, and biodiversity. Technical CDR is not yet mature, with a few BECCS demonstration plants being built in Scandinavia, and costs are still high. For DACCS, estimates range from USD 400–1,000 (Bednar et al., 2023), decreasing to USD 200–400 by 2050 (Al-Juaied & Whitmore, 2023). The IPCC (2022b) estimates costs of USD 15–400 for BECCS, with the higher end more likely (Bednar et al., 2023). Costs depend on the technology, related resource and energy needs and prices, and costs for transport and storage. They are likely to decrease quicker for DACCS than BECCS as the latter is subject to potential cost increases for land biomass (Fuss et al., 2018). While BECCS and DACCS offer significant CO<sub>2</sub> removal potential, other solutions are also being developed and deployed at small scales, such as biochar, with own risks and potentials (Smith et al., 2023).

### Indicators:

- Attention to technical CDR
- Costs of BECCS and DACCS [EUR/ t CO<sub>2</sub>e]

**Policy context:** The ICMS (EC, 2024c) aims at boosting technical CDR amongst other objectives. It highlights the need for national policies and strategic infrastructure planning at EU level and foresees industrial carbon management to be an ‘integral part of EU’s economic system’ after 2040 and the creation of a single EU market for CO<sub>2</sub>. For this, the EC plans to increase incentives for investing in CDR across the entire value chain, including the EU CFCR and considering the potential for including CDR in the EU Emissions Trading System (ETS) Directive, which will be assessed by 2026. Additional actions will complement the existing policies including the Carbon Capture and Storage (CCS) Directive as well as already existing funding under Horizon Europe and the Innovation Fund, which both finance technical CDR projects as part of the CCS funding category (Carbon Gap, 2023c, 2024a; EC, 2022g). Regulating technical CDR is picking up speed on a Member State level with 23 Member States having formal CDR strategies in place (Carbon Gap, 2024b) and others, including Germany, additionally having a strategy for long-term negative emissions (BMWK, 2024).

**Areas of action:** To develop the potential of technical removals within the EU and broaden the deployment of technical CDR post-2030, additional funding for research, development, and demonstration (RD&D) is called for. This funding should focus on the sustainable application of CDR, ensuring that the full lifecycle emissions are lower than the CO<sub>2</sub> captured, that technical CDR is powered by renewable energy, and that it does not exert pressure on water or food security (IPCC, 2023). Any funding of CDR should require monitoring of these sustainability criteria (see e.g. Carbon Gap, 2024c). Looking forward, a comprehensive legal framework based on the CFCR and the CCS Directive should be set up to incentivise the sustainable deployment of technical CDR in the longer-term. In addition, coordinated and co-operative planning and development of infrastructure such as pipelines and storage sites are needed within and between Member States.



# Lifestyles



## Far too slow

Sustainable behaviour patterns and social practices, enabled by policies that make sustainable options accessible, affordable, and the default, are key for decarbonisation.

## 4.7 Lifestyles



**Past progress:** Progress towards sustainable lifestyles has picked up in speed compared to last year’s classification, but it is still **far too slow**. This is primarily due to positive developments in the diffusion of climate-friendly habits such as choosing plant-based options or taking self-reported action for the climate. However, limiting emissions from consumption still has a long way to go: The average carbon footprint of EU citizens declined far too slowly over the period assessed, and material consumption was even increasing. Scarce data availability, particularly regarding infrastructure development and economic incentives, and the lack of official targets makes it challenging to assess the overall progress in this building block (Chancel, 2022).

**Policy context:** At present, the EU does not have an overall strategy targeting sustainable lifestyles. There are policy and implementation gaps in demand-side measures. However, there is movement in some Member States and local governments, and in some instances, lifestyle choices are tackled by other policy areas. The *LIFE* scenario of the impact assessment to the 2040 climate target (EC, 2024j) shows how changes in lifestyles could reduce energy, land, and resource use. New and upcoming EU policy proposals support sustainable behaviour. The Circular Economy Action Plan lists measures to decrease resource use and provides data for monitoring progress. The EU Alternative Fuel Infrastructure Regulation (AFIR) and the revision of the trans-European transport network (TEN-T) (EP, 2023d) would support the shift to more sustainable mobility choices.

**Areas of action:** A key necessity for advancing progress in lifestyles is the establishment of a comprehensive policy framework. The number of current policies targeting changes in behaviour is marginal. A first step is the Joint Research Centre’s (EC, 2024d) Competence Centre on Behavioural Insights, which examines how values should be considered in policy-making. In addition, data availability in this building block is sparse and leaves little room for drawing conclusions on where progress might be insufficient. A low-hanging fruit is the consideration of data on EU funding for investments into enabling infrastructure in the regular assessments of EU funds. Finally, data on benchmarks is inexistent, underlining that lifestyle changes still is not a significant policy priority for the European Union.

**Table 16: Progress in lifestyles towards the objective and enablers**

OBJECTIVE	ENABLERS		
Limiting emissions and resource use 	Providing enabling infrastructure 	Enhancing economic incentives 	Diffusion of climate neutral habits 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information. Source: ©ECNO.

Table 17: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Limiting emissions and resource use</b>						
Per-person material footprint [t/capita]		2017–2022 (Eurostat, 2024t)	+0.1% per year	+14.1 t/capita	n/a	n/a
Per-person carbon footprint from household expenditure [tCO <sub>2</sub> /capita]		2015–2020 (Eurostat, 2024s)	-3.2% per year	-0.1 tCO <sub>2</sub> /capita per year	n/a	n/a
<b>ENABLER 1: Providing enabling infrastructure</b>						
Investment in cycling infrastructure [EUR]		n/a	n/a	n/a	n/a	n/a
Population living in municipalities that promote sustainable food in canteens [%]		n/a	n/a	n/a	n/a	n/a
<b>ENABLER 2: Enhancing economic incentives</b>						
Price on carbon [EUR/t CO <sub>2</sub> ]		n/a	n/a	n/a	n/a	n/a
Affordability of vegetarian compared to meat options		n/a	n/a	n/a	n/a	n/a
<b>ENABLER 3: Diffusion of climate neutral habits</b>						
Self-reported climate-conscious behaviour [% of population]		2018–2023 (Eurobarometer, 2023a)	+1.2% per year	+0.8 %-points per year	n/a	n/a
Climate-damaging advertisement [EUR]		n/a	n/a	n/a	n/a	n/a
Sales trends of plant-based food items in EU [EUR billion]		2020–2022 (Good Food Institute, 2022)	+11.8% per year	EUR 0.5 billion per year	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Limiting emissions and resource use

**Past progress:** Through the end of 2022, average per capita material consumption in the EU increased after a slowdown caused by the pandemic and was thus moving in the **wrong direction**. Non-metallic minerals make up around half of the materials consumed. The EU's level of resource use surpasses the planet's safe operating space (EEA, 2023c). The carbon footprint from household expenditure decreased on average over the period, albeit this development was still **far too slow** and will need to accelerate significantly to be in line with climate neutrality by 2050.

### Indicators:

- Per-person material footprint
- Per-person carbon footprint from household expenditure

**Policy context:** The Circular Economy Action Plan, updated in 2020, aims to reduce raw material inputs into the EU economy, which in turn also reduces the raw material footprint of each EU citizen. The circular economy monitoring framework was revised in 2023, adding valuable data input for policy-making. In addition, the EC proposed a directive 'on common rules promoting the repair of goods', securing a 'right to repair', which encourages citizens to repair viable defective goods to reduce waste and resource use (EC, 2023ac), as well as introducing stricter rules on more sustainable packaging in the EU to reduce avoidable resource use (EC, 2022j).

**Areas of action:** The above outlined proposal shows that the year 2023 saw several strategies within the EU Green Deal targeting the problem. Still, relevant proposals remain pending, especially regarding the agriculture and food sectors. The commitment to detailed monitoring using circular economy indicators is a step towards improved data availability. While some policies would benefit from higher ambitions, the EC may firstly focus on delivering on implementation (ESABCC, 2024). Policy-makers have the responsibility to support both policy development and implementation adequately, through setting economic incentives, educating and empowering consumers, and setting the right legal frame for decoupling resource use and economic growth.

## Enabler 1: Providing enabling infrastructure

**Past progress:** Infrastructure provisions should make sure that the most sustainable option is available for users, or at best the most convenient one to choose. At present, there are **no data** available that allow for a comprehensive assessment.

Looking at investment in cycling infrastructure at EU level, a 2023 report by the European Cyclists' Federation provides only a general indication along one dimension (Küster, 2023). The report compared the combined total planned investments by Member States from EU Structural Funds from the periods 2014 to 2020 and 2021 to 2027, highlighting a 32% increase. Sustainable public procurement, promoting the increase of plant-based foods in canteens, is not monitored at the EU level. Locally, there are some cities and regions that stand out as good practices, e.g., a plant-based option required in Portuguese canteens or the support for more vegetarian collective catering through the French Climate Law (European Vegetarian Union, 2023).

### Indicators:

- Investment in cycling infrastructure
- Population living in municipalities that promote sustainable food in canteens

**Policy context:** There are no overarching policy roadmaps that focus on promoting climate neutral behaviour through infrastructure expansion. Still, some specific regulations under the Green Deal nudge consumers towards more sustainable ways of living. The adoption of the EU Alternative Fuel Infrastructure Regulation (AFRI), increasing the number of electric charging stations and allowing users to pay with a credit card, will make it more convenient for consumers to choose an electric vehicle. Further, the EU funds projects that aim to provide the necessary surroundings for changing behaviour. As an example, the interregional NiCE project restructures city centres to encourage local and circular consumption (Interreg, 2024). The Social Climate Fund is supposed to increase access to sustainable transport (EC, 2024q). In line with the New Urban Mobility Framework (EC, 2021q), the EC proposed a 'European Declaration on Cycling' (EC, 2023f), following the EP's resolution on developing a cycling strategy (EP, 2023c). Since 2020, Next Generation EU has created fiscal space for Member States to invest in a vast array of projects, including railway infrastructure. Meanwhile at national and local level, some investments continue to go in the opposite direction.

**Areas of action:** If sustainable daily lifestyle choices are to become easy for citizens, EU policies need to deliver on the right 'choice architecture' (Thaler & Sunstein, 2021). Considerate spatial planning, offering safe bike lanes, reliable public transport options and a network of electric charging stations, make it more expedient for consumers to stop relying on fossil fuelled mobility. Public procurement can be a trendsetter by regularly providing vegetarian and vegan options. Legislation has so far been fragmented and is scattered around different legislative proposals. EU public funding granted to Member States (e.g. Recovery and Resilience Facility) and regions (e.g. ERDF) can support the deployment of such infrastructure, or least ensure that they do not promote the development of unsustainable lifestyles, but details on the use of this EU funding is scarce and incomplete. A citizen-centric comprehensive strategy is needed to plan and encourage the necessary behavioural shifts.

## Enabler 2: Enhancing economic incentives

**Past progress:** Implementing carbon pricing makes unsustainable products and services more expensive. The OECD monitoring of net effective carbon rates show an increase from 2018 (EUR 58.9 per t CO<sub>2e</sub>) to 2021 (EUR 74.7 per t CO<sub>2e</sub>) (OECD, 2018, 2021). However, the carbon price might need to reach around EUR 190 by 2030 to align with climate neutrality (Pietzcker et al., 2021). There are no EU-wide aggregated data on the affordability of vegetarian options compared to meat options. The little information available has been compiled by NGOs, e.g., in Germany, where plant-based alternatives held a 25% price premium in comparison to conventional meat and dairy products. This marks a reduction from the 53% premium estimated in 2022 (Gerstenberg, 2023).

### Indicators:

- Price on carbon
- Affordability of vegetarian compared to meat options

**Policy context:** The proposed Energy Taxation Directive (ETD) (EC, 2023as) and the adopted reform of the EU ETS Directive may lead to a price increase for products and services with high carbon footprints. The revised ETD aims to order fuels and electricity according to their environmental performance, making Member States tax them adequately. Through this, products most polluting during their production are taxed highest. For now, carbon pricing fails to cover all emission sources, and simultaneously, EU subsidies may counteract its effectiveness. According to a report from WWF, EU subsidies for locally produced animal products negatively affect the affordability of sustainable diets, for instance (WWF, 2023).

**Areas of action:** Taxing carbon does not only drive consumers away from more carbon-intensive products, but further generates revenues that countries can use for investments needed for the transition to climate neutrality (ECNO, 2023). Measures and policies are promising, but policy-makers need to make sure they are comprehensive and include all emitting products and services. The EU still heavily subsidises the use of fossil fuels, which needs to be reduced and ultimately terminated. When applying carbon prices, designing the measure to be non-regressive is crucial, e.g., through paybacks.

## Enabler 3: Diffusion of climate neutral habits

**Past progress:** Through 2023, progress towards the diffusion of climate neutral habits was **on track**. This suggests some movement in European societies towards making the sustainable option the norm. Looking at the Eurobarometer’s biennial self-assessment, an increasing number of EU citizens have personally taken action to fight climate change in the last six months. This correlates with an increased awareness of the seriousness of climate change (Eurobarometer, 2023a). As there are no aggregated EU data on investment in advertisement campaigns for carbon-intensive products, the absolute sales of plant-based food items were considered as a proxy. These show remarkable increases from 2020 to 2022 (i.e., meat and dairy alternatives), providing further evidence for a proliferation of climate-friendly norms. The trend has been driven by the increased availability and popularity of plant-based products among the population (EC, 2024q).

### Indicators:

- Self-reported climate-conscious behaviour
- Climate-damaging advertisement
- Sales trends of plant-based food items in EU

**Policy context:** The proposed Ecodesign Regulation seeks to promote sustainable energy-related products as the market default by, i.a., strengthening repairability and durability requirements (EC, 2022o). Other EU legislative endeavours, however, risk deterring consumers from perceiving the sustainable option as the norm. For instance, the European Court of Justice ruled in 2023 that purely plant-based products cannot be labelled with words traditionally reserved for animal products, such as ‘milk’ or ‘yoghurt’, even if they come with a clear distinction, e.g., ‘tofu cheese’ (CJEU, 2017). Likewise, most public funding for agricultural production in the EU still supports climate-damaging business models like meat and dairy farming, as well as direct subsidies for their advertising (EREA, 2023). This potentially locks food producers in instead of incentivising them to explore alternatives (Vallone & Lambin, 2023).

**Areas of action:** Looking at sustainable food consumption, EU legislation still favours the consumption of meat and dairy products (ECA, 2021). The EU needs to acknowledge the necessity of a dietary transition and follow up with adequate policies. Habits must also shift regarding to how people move, consume, and heat. Allowing the use of animal product names for plant-based alternatives can be a first low-effort step. Informing citizens both about alternatives and about why other options can be beneficial is one way for the EU to support making the sustainable option the norm. Further, applying stricter sustainability standards, as done by the Ecodesign Directive, for appliances on a wider range of services, products, and food items can help drive unsustainable practices out of the EU market.



# Clean Technologies



## Too slow

Clean technologies are the backbone of a decarbonised economy. It is vital to deploy the most effective climate solutions, and that citizens reap the benefits of green industrialisation.

## 4.8 Clean technologies



**Past progress:** The development of clean technologies in the EU was found to be **too slow**, which means there is no change to the progress classification of last year. While the EU research and innovation architecture remained vibrant, with significant public funding, private R&I spending was progressing too slowly in the period assessed. Investment in start-ups was growing, and the manufacturing base for more mature clean technologies continued to increase. However, private finance to these at-scale projects plateaued, risking continued progress.

**Policy context:** The EU has a range of policies which support research and innovation, manufacturing, and deployment of clean technologies. The Fit for 55 package creates the market conditions and future demand for clean energy, electric mobility, and other technologies. A range of funds and financial instruments are already in place to support clean technologies (Humphreys, 2023b). 2023 saw the proposal of the EU’s Green Deal Industrial Plan (EC, 2023ar), a package of measures aimed at European clean technologies. With implementation expected by the end of 2024, their impact on the progress of EU clean technologies is yet to be assessed.

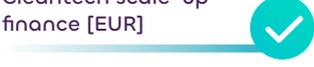
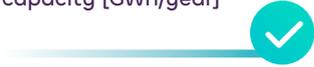
**Areas of action:** A holistic strategy is required to drive progress in clean technologies. Key actions include prioritising the full implementation of legislative initiatives like the Net Zero Industry Act, to streamline permitting processes and accelerate market entry. Additionally, leveraging mechanisms such as the proposed ‘regulatory sandboxes’ will facilitate the transition of research into market-ready solutions. Above all, addressing the absence of a cleantech investment plan should be a priority to mobilise private and public capital effectively. This should be pursued at the EU level to avoid a fragmentary state aid competition between Member States (MS), such as that seen under the current Temporary Crisis and Transition Framework (Humphreys, 2023a). Expanding the size and scope of the EU Innovation Fund, expanding the size of Horizon Europe, and leveraging EIB instruments such as guarantees and venture debt should be key pillars of such an approach.

**Table 18: Progress on clean technologies towards the objective and enablers**

OBJECTIVE	ENABLERS		
Developing manufacturing capacity & innovation leadership 	Fostering research excellence 	Bringing innovation to market using private resources 	Increasing clean technology uptake 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. [See Table 35](#) for further information. Source: ©ECNO.

Table 19: Details on indicators' past progress and required change

2023		Historical data			Required change	
2024 >		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Developing manufacturing capacity &amp; innovation leadership</b>						
Clean technology industry added value [bnEUR]		2015–2020 (Eurostat, 2023a)	4.6% per year	EUR 5.6 bn per year	n/a	n/a
Index of eco-innovation patents [Patents/Mhead/year]		2017–2022 (EC, 2023i)	-1.2% per year	-1.1 per Mhead per year	n/a	n/a
<b>ENABLER 1: Fostering research excellence</b>						
Index of Eco-Innovation related publications [Publications/Mhead/year]		2017–2022 (EC, 2023i)	4% per year	6.6 per Mhead per year	n/a	n/a
Public funds for environmental and energy R&D [% of GDP]		2016–2021 (IEA, 2024a)	5.6%-points per year	0.0%-points per year	n/a	n/a
<b>ENABLER 2: Bringing innovation to market using private resources</b>						
Private energy R&I spending [% of GDP]		2014–2019 (EC, 2024i)	1.9%-point per year	0.0%-points per year	n/a	n/a
Early-stage private cleantech investment [EUR]		2018–2023 (Cleantech for Europe, 2024)	47% per year	EUR 615 million per year	n/a	n/a
<b>ENABLER 3: Increasing Clean Technology uptake</b>						
Share of green public procurement [n/a]		n/a	n/a	n/a	n/a	n/a
Cleantech scale-up finance [EUR]		2018–2023 (Cleantech for Europe, 2024)	40.9% per year	EUR 1.5 billion per year	n/a	n/a
Battery manufacturing capacity [GWh/year]		2021–2023 (Bielewski et al., 2022; IEA, 2023d; T&E, 2024b)	131.1% year	91.5 CWh/year	550 CWh by 2030 (EC, 2023ah)	46.1 CWh/year → <b>0.5 times faster</b>

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Developing manufacturing capacity & innovation leadership

**Past progress:** The ECNO indicators tracking progress on this enabler show progress on the growth of the clean technology industrial base was steady, yet **too slow**, while the performance of the research ecosystem declined. The steady growth of the clean technology industrial base was hampered by problems of access to finance (Tech for Net Zero, 2021), slow permitting times (EC, 2023e), and increased competition from the United States and other jurisdictions (Jansen et al., 2023). The decline in the performance of the research sector is harder to attribute a cause to, although regular cuts to EU research funding (Zubaşcu, 2024) could be a contributing factor.

### Indicators:

- Clean technology industry added value
- Index of eco-innovation patents

**Policy context:** The past year has seen the EU conclude interinstitutional negotiations on key pieces of legislation for clean technologies, under the umbrella of the Green Deal Industrial Plan (EC, 2023ar). Of the three pieces of legislation introduced as part of the Plan (incl. the Net Zero Industry Act, Critical Raw Materials Act (CRMA), and the Strategic Technologies for Europe Platform), the Net Zero Industry Act (NZIA) has the potential to significantly improve EU progress in developing its domestic clean technology industry. However, its impact remains to be seen, as it is yet to be implemented.

When looking at the next generation of clean technologies, the EU has a wide-ranging research policy architecture which supports researchers and cleantech start-ups. The most notable of these is the support through Horizon Europe, as well as the European Institute of Innovation & Technology, European Research Council, and European Innovation Council, among others (Humphreys, 2023b). Fresh support to research and innovation is also expected through the NZIA and its establishment of ‘regulatory sandboxes’ at MS level. Alongside this EU-level support, there are a range of national programs, such as the German Energy Efficiency and Renewable Energy programme (KfW, 2024) and the French Investments for the Future programme (ADEME, 2021). Indeed, the majority of public finance for R&D comes from these national-level programs, with Member States’ contributions (EUR 117 billion in 2022 (Eurostat, 2024g)) greater than comparable EU-level programs (EUR 2.2 billion in 2022 (EC, 2024f)).

**Areas of action:** The full implementation at MS level of the Net Zero Industry Act should be a priority, as it will address some of the barriers which slow the progress of clean technologies, such as long permitting times. The ‘regulatory sandboxes’ found in the NZIA can support the accelerated transformation of research excellence into innovative products. However, the lack of a public cleantech investment plan limits the EU’s progress in this building block. The private investment landscape for clean technologies still comes with structural weaknesses and could be improved by strategic investment (Detzner et al., 2023). Therefore, proposing an effective answer at the EU level to the question of investment is of crucial importance.

## Enabler 1: Fostering research excellence

**Past progress:** Progress on maintaining EU research excellence in the clean technology sphere remained robust over the period assessed but is threatened by a lack of finance. Although eco-innovation patent activity was down, the European clean technology research environment remained active. Europe's progress on publication of research activity was **on track**, with a spike in activity observable in the most recent datapoint of 2022 (increasing almost 17% year-on-year). However, while researchers continue to push the boundaries of the state of the art, they do so in an environment that is increasingly financially constrained. Public funding allocated to environmental R&D has been assessed as **on track**, although continues to lag levels seen in the US and China (Matthews, 2024).

### Indicators:

- Index of Eco-Innovation related publications
- Public funds for environmental and energy R&D

**Policy context:** As discussed, the EU-level public architecture for supporting research and development/innovation is developed and well-financed. Horizon Europe is the most significant of these bodies. It is threatened by cuts, as evidenced during the 2024 mid-term budget negotiations, which saw the fund reduced by EUR 2.1 billion (Zubaşcu, 2024). The proposed Strategic Technologies for Europe Platform's (STEP) top-up of EUR 0.5 billion to Horizon Europe (complemented with EUR 2.13 billion of redeployment and use of decommitted amounts) was cancelled in the same negotiations. Beyond the addition of the concept of 'regulatory sandboxes' in the NZIA, there has not been a significant regulatory push to support clean technology innovation with new instruments or programmes.

**Areas of action:** While the Horizon programme is well-financed, it could be supported with much more capital to have yet a greater impact. To illustrate this, the current programme's predecessor, Horizon 2020, required a further EUR 159 billion to fund all proposals judged 'above the quality threshold' (EC, 2024l). Forthcoming EU debates (expected to begin in earnest 2025) on the successor to Horizon (known as FP10) should foreground the need to increase research funding for clean technologies. In the worst case, current levels should be defended, as evidenced by the recurring phenomenon of redirecting R&D funding to support other priorities.

## Enabler 2: Bringing innovation to market using private resources

**Past progress:** Bringing cutting edge research ideas in the field of clean technologies to market requires not only public support but the interest and investment of the private sector. Private investment in R&I was progressing

**far too slowly** through 2023, with companies unwilling to take a risk on future innovations with uncertain returns – even with some Member States subsidising such investment (W&K Grant Thornton, 2021). However, once a prototype has left the lab and is being brought to market by a start-up or other small-scale innovator, the financing landscape looked more promising. Private early-stage finance, or ‘seed’ and ‘series A’ finance in start-up terminology, was **on track**, with an inflation adjusted increase of 105% between 2020 and 2023, and an average annual increase of 164% from 2011 on.

### Indicators:

- Private energy R&I spending
- Early-stage private cleantech investment

**Policy context:** One of the EU’s principal instruments for supporting private sector investment in R&D and early-stage companies, with a focus on the deployment and demonstration of new and/or improved clean technologies, is the EU Innovation Fund. The Innovation Fund disburses grants through regular calls for projects, and its small-scale and medium-scale calls are important resources for crowding in private capital in growing start-ups (Humphreys, 2023b). The EIB’s InvestEU and Venture Debt programs are also valuable financial instruments in supporting early-stage projects and de-risking investors. R&I investment is, as already mentioned, covered by a wide range of EU programs, of which Horizon is the largest. The impact of these public programs at catalysing private investment is uncertain. One long-unresolved EU policy debate, which could support the future progress of EU private finance for start-ups and innovators, is the completion of the Capital Markets Union (Demertzis, 2023). By breaking down the barriers making it more difficult for investors to support projects in other Member States, European venture capital could become more available across the EU.

**Areas of action:** As part of discussions for the next EU Commission mandate in 2024, serious consideration should be given to better financing EU financial instruments which catalyse public investment in R&D and the demonstration of early-stage clean technologies. Increasing the size of the Innovation Fund and completing the Capital Markets Union would be two important policy steps towards this. Attention should also be given to the oft-overlooked field of Innovation Procurement, where government purchases can support the access to market of the next generation of clean technologies (EC, 2024g).

## Enabler 3: Increasing clean technology uptake

**Past progress:** The most significant contribution to European decarbonisation by clean technologies is represented in the manufacturing and deployment of the most mature and market-ready solutions, with progress having been mixed in recent years. Recent data on the manufacturing capacity for the clean technology with the greatest investment needs (EC, 2023w), batteries, show that growth was **on track**. However, this progress may be at risk as scale-up finance for clean technologies shows signs of reaching a plateau in the period assessed, with scale-up finance for clean technologies slightly declining over the past two years (which is even greater when adjusting for inflation, at 26%). Rising interest rates (Partington, 2023), difficult economic conditions (Marshall, 2023), and the increasing attractiveness of the American market, where clean manufacturing investment had grown 171% a year since the Inflation Reduction Act (Bermel et al., 2023), are all contributing factors to this trend.

### Indicators:

- Share of green public procurement
- Cleantech scale-up finance
- Battery manufacturing capacity

**Policy context:** The continued growth of clean technology manufacturing is dependent largely on continued investment. Yet policy also plays a significant role, whether it be regulation which creates the market conditions and expected demand for clean technologies (demand pull measures) or investments and subsidies which can de-risk and crowd-in private capital (supply push measures). The EU policy architecture is strong in the former case (Fit for 55), weaker in the latter. The NZIA and Critical Raw Materials Act (CRMA), with their EU production targets for clean technology supply chains, is another policy signal to investors. However, without concrete flanking measures to ensure adequate investment, their impact remains to be seen. The NZIA also introduces sustainability and resilience criteria to renewables auctions and public procurement calls, although as currently designed their impact in supporting greener EU cleantech manufacturers is likely to be marginal. However, when it comes to investment, the EU has not followed the example of the US, or, for that matter, of China, Canada, Japan, or South Korea, in using public subsidies to accelerate private investment (Bermel et al., 2023). While investment platforms such as the Innovation Fund or InvestEU are significant sources of public finance at the EU level (Humphreys, 2023b), 2023's proposed STEP fund delivered almost nothing in the way of targeted finance for clean technologies (Simon, 2024), contributing little to bridging the investment deficit (Calipel et al., 2024).

**Areas of action:** To encourage the use of green public procurement to accelerate clean technology uptake, an ambitious implementation by Member States of the NZIA sustainability and resilience criteria is important. Similarly, ensuring that Member States abide by and have the resources to process permitting claims for factories in line with the NZIA and prioritise efforts to tackle structural skills shortages for these factories, is also a way to tackle the non-price barriers to the further expansion of the cleantech industrial base. Furthermore, an ambitious cleantech investment plan as a priority for the next EC could mobilise new resources at the European level and harmonise governance structures, making financing clear and predictable.



# Finance



## Wrong direction

Redirecting financial flows towards the transition is essential to put the EU on track to achieve climate neutrality by 2050. This includes both public and private investment flows.



## 4.9 Finance

**Past progress:** The development of financial flows towards transition financing in the EU was heading in the **wrong direction** in the assessed period, which means there is no change to the progress classification of last year. This is primarily due to the fact that the climate investment gap for the EU to achieve its climate objectives by 2030 was still significant, amounting to EUR 406 billion in 2022 for the energy, buildings and transport sector. This represents half of the investment that would have to be made every year between now and 2030 to achieve these targets. In the meantime, fossil fuel subsidies increased considerably in 2022 due to the energy crisis, reaching EUR 190 billion. Finally, the quality of information about how banking institutions currently finance and plan to finance the transition was very low, with the quality of the contents of banking transition plans and their timeline of publication still having been uncertain.

**Policy context:** There are currently no regulations that coordinate an efficient redirection of both public and private financing towards EU climate objectives to close the climate investment gap. However, the EU has implemented several measures, such as carbon taxation through the EU ETS public subsidies, or financial regulation, to redirect financial flows towards a low-carbon economy. The EU’s 8<sup>th</sup> Environmental Action Programme urged Member States (MS) to phase-out fossil fuel subsidies as soon as possible, but no sanctions are applied to MS if they fail to do so. With the adoption of the Corporate Sustainability Due Diligence Directive (CSRD) in 2023, and the revision of the Capital Requirement Directive (CRD) in 2023, banking transition should become progressively mandatory. The CSRD and CRD, if sufficiently sound and effective, could enable the redirection of private financial flows toward the transition to a low-carbon economy.

**Areas of action:** Given its significance, the climate investment gap should be better assessed and addressed with urgency, otherwise there is a risk of seeing the Green Deal failing to deliver. It will require comprehensive public policy that involves existing regulation, such as carbon pricing systems, but also public finance schemes and financial regulation to mobilise both public and private investments. An EU long-term climate investment plan could help bridge the gap in climate investment by effectively coordinating public funding and private financing. This is particularly important as the Recovery and Resilience Facility (RFF) is set to end in 2027. To achieve EU climate targets by 2030, it is also essential that MS cease their fossil fuel subsidies as quickly as possible. Finally, although legislative progress has been made in recent years on the obligation for banks to publish transition plans, their publication timeline, and their soundness to effectively enable banks to better finance the transition still need to be clarified.

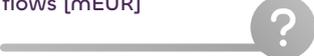
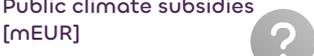
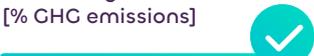
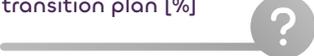
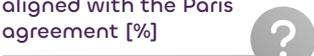
**Table 20: Progress in finance towards the objectives and enablers**

OBJECTIVE	ENABLERS		
Financing climate change mitigation  	Channelling public funds away from fossil fuels and towards climate neutrality  	Modifying market prices through public intervention  	Shifting private finance towards climate-friendly financing  

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 21: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change		
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.	
<b>OBJECTIVE: Financing climate change mitigation</b>							
		The Climate Investment Gap [% EU GDP]	2022 (Calipel et al., 2024)	n/a	n/a.	0 (2022)	-100%
		Climate-hostile financial flows [mEUR]	n/a	n/a	n/a	n/a	n/a
<b>ENABLER 1: Channelling public funds away from fossil fuels and towards climate neutrality</b>							
		Public climate subsidies [mEUR]	n/a	n/a	n/a	n/a	n/a
		Fossil fuel subsidies [mEUR 2022]	2017–2022 (OECD & IISD, 2024)	36.3%	21,122.8 mEUR/yr	0 by 2025	-63,461.9 mEUR /yr → needs U-turn
<b>ENABLER 2: Modifying market prices through public intervention</b>							
		Share of GHG emissions covered by a carbon tax [% GHG emissions]	2017–2022 (Fleurence et al., 2023)	3.2%	1.5% -points/yr	n/a	n/a
		Revenues from environmental taxation [% total tax revenues]	2017–2022 (Eurostat, 2024u)	-3.4%	-0.4 % -points/yr	10% of total tax revenues by 2020	0.2%-points per year → needs U-turn
<b>ENABLER 3: Shifting private finance towards climate-friendly financing</b>							
		Share of banks with a sound transition plan [%]	n/a	n/a	n/a	n/a	n/a
		Share of new banking loans aligned with the Paris agreement [%]	n/a	n/a	n/a	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Financing climate change mitigation

**Past progress:** Progress towards the objective of financing climate change mitigation was **too slow**. Despite an increase in climate investments in recent years, the EU still faced a substantial investment gap of EUR 406 billion in 2022 (Calipel et al., 2024) for the energy, buildings and transport sector to meet its climate targets by 2030. That represents 2.6% of EU 2022 GDP (Eurostat, 2024r). However, EU climate investments grew by 15% in 2021 and by 9% in 2022, implying a positive development in the climate investment gap (Calipel et al., 2024). At a more granular level, almost all sectors of the EU economy, suffered from climate investment gaps of varying widths. For instance, 2022 investments in wind power represented only 17% of total annual investment needs. Conversely, investments in solar panels already represented 78% of total annual investment needs (Calipel et al., 2024). Furthermore, there is no EU-wide aggregated data available on EU financial flows that contribute to significant GHG emissions. However, it seems likely that the EU is not **on track** of phasing out climate-hostile investments. The IEA (2023g) estimated that USD 122 billion had been invested in fossil fuels on the European continent in 2023. This is 12.3% higher than in 2022. However, the data covers a wider area than just the EU, so that it can only provide a very rough estimate for the EU.

### Indicators:

- The Climate Investment Gap
- Climate-hostile financial flows

**Policy context:** Currently, there are no regulations in place to address the climate investment gap or to decrease climate-hostile investments in a comprehensive way. However, the EU has implemented several measures, such as carbon pricing through the EU ETS or public subsidies, to redirect financial flows towards a low-carbon economy. Without coordination of these public policies, and between their different levels (European, national, local), there is little chance that the climate investment gap will close on its own.

**Areas of action:** Given its significance, the EC should better assess and address the EU climate investment gap (Calipel et al., 2024), or risks seeing the Green Deal failing to deliver. The EC is already carrying out analyses of investment needs and the climate investment gap, for both the 2030 (EUR 1.2 trillion per year between 2021 and 2030) (EC, 2023ap) and 2040 targets (EUR 1.5 trillion per year between 2031 and 2030) (EC, 2024q). However, the EC's assessment is not updated from year to year. The assessments should be done on an annual basis, and should be needs-driven, accurate, and based on granular data at the EU, national, and local levels. They should also be comprehensive, covering all sectors of the economy. Addressing the climate investment gap requires a comprehensive approach that involves existing regulation, such as carbon pricing systems, public finance schemes or financial regulation. An EU-level long-term climate action financing plan would enable a right articulation of public funding and private financing of the climate investment gap. If the EU granted EUR 254 billion to climate action from the Recovery and Resilience Facility (RFF) funds over the period from 2021 to 2027 (EC, 2023am), these investments will come to an end in 2027. The EU institutions should therefore consider the option of integrating a long-term climate action financing plan in the negotiations for the next EU long-term budget (MFF) for 2028 to 2034.

## Enabler 1: Channelling public funds away from fossil fuels and towards climate neutrality

**Past progress:** There are currently no official aggregated data at the EU level on all climate subsidies. EU climate investment subsidies represent the sum of public subsidies from the EU, its MS, and their local authorities, going towards climate investments. It could include for instance subsidies to renewables, or subsidies to help households renovate their homes, buy an electric car, or install a heat pump. Some partial data exist, for example on subsidies granted to renewable energies. They amounted to EUR 87 billion in 2022, and were well below the level of fossil fuel subsidies for the first time since 2015. Subsidies for renewable energies had increased by 7.3% in 2020 to reach EUR 88 billion. They have remained relatively stable since then (EC, 2023a). The decrease in income and price support schemes (feed-in tariffs, feed-in premiums, etc.) due to the rise in electricity prices (-10.3% in 2021) were compensated by the increase in direct transfer subsidies (mainly grants), which were multiplied by 3 between 2020 and 2022 (EC, 2023a). However, progress towards channelling public funds away from fossil fuels was still going in the **wrong direction** in the period assessed. Fossil fuel subsidies have almost tripled between 2021 and 2022, reaching EUR 190 billion (OECD & IISD, 2024). This growth in fossil fuel subsidies is mainly due to the energy crisis generated by the Ukraine war, which led EU MS to adopt more than 230 temporary subsidy measures to protect households and companies from the rise of energy prices (EC, 2022m) ([see enabler 2](#)).

### Indicators:

- Public climate subsidies
- Fossil fuel subsidies

**Policy context:** The EU's 8th Environmental Action Programme (EAP) urged MS to phase out fossil fuel subsidies as soon as possible. This objective to end all fossil fuel subsidies by 2025 was reaffirmed by European parliamentarians at COP 28 (EP, 2023b). The 8th EAP requires that MS report on their action plan to phase out fossil fuel subsidies on an annual basis. According to these reports, many MS plan to move away from fossil fuel subsidies but only a few have translated these ambitions into laws or clear plans (EC, 2022m). The Energy Taxation Directive (ETD) (2003) still allows fossil fuel subsidies for certain sectors through tax exemptions, in particular for commercial shipping, aviation, and the fisheries sectors. This ETD is currently being revised by the European institutions, with the possibility of ending these exemptions.

**Areas of action:** To enable the redirection of financial flows from fossil assets to climate neutral ones, it is essential that fossil fuel subsidies are replaced by climate subsidies as soon as possible. More pressure should be put on MS to publish action plans with clear dates for phasing out fossil fuel subsidies and with information about how they will ensure this happens, as already planned in the EU's 8th Environmental Action Programme. Furthermore, the ETD should be revised to exclude the tax exemptions for fossil fuels in the aviation and maritime sectors. Finally, more progress could be made by establishing a clear framework for ensuring long-term climate subsidies. This would provide economic actors with predictability regarding public support for climate investments.

## Enabler 2: Modifying market prices through public intervention

**Past progress:** The share of EU GHG emissions covered by a carbon market price or tax was stable in 2022 (Fleurence et al., 2023) and was overall assessed as **on track**. However, the share of EU and Member States (MS) revenues from environmental taxation were still going in the **wrong direction** in 2022. They represented 4.9% of total EU and MS tax revenues in 2022, against 5.43% in 2021 (Eurostat, 2024u). This decline over the years can be explained by the fact that many MS found it difficult to increase the cost of necessary goods, such as food and energy, by increasing environmental taxes while the country was experiencing social and economic difficulties (EEA, 2023g). The share of revenues from environmental taxation has been falling overall over the last 10 years. In 2013, it represented 6.04% of total revenues from taxation (Eurostat, 2024u).

### Indicators:

- Share of GHG emissions covered by a carbon tax
- Revenues from environmental taxation

**Policy context:** In its Roadmap to a Resource Efficient Europe (EC, 2011), the EC set the objective that each MS should shift their average share of environmental taxation in public revenues to more than 10% (in line with the best performing MS in 2011) by 2020. On average, this target has not been met at the EU level. However, this target is still considered relevant, as environmental taxes encourage producers and consumers to pollute less and use resources more sustainably (EEA, 2023g). Moreover, a significant amount of these revenues must be used towards environmental objectives (at least 50% of EU ETS auctioning must be spent for climate- and energy-related purposes). The share of EU GHG emissions covered by a carbon market price or tax is mainly affected by the decisions by Member States to implement a carbon tax or market in their country, and by the EU ETS framework. The share of EU GHG emissions covered by the EU ETS decreased since 2017, from 39% in 2017 to 36% in 2022. The overall increase in coverage in the EU is mainly due to the introduction of carbon taxation frameworks within the Member States. However, the revision of the EU ETS Directive and the creation of a new ETS (ETS2), including road transport and buildings and adopted by the EP and EC in April 2023, could significantly increase the EU GHG emissions coverage, up to around 80% (Marcu et al., 2023).

**Areas of action:** Revenues from environmental taxation are still too low within the different Member States compared to what is expected by the EU. In the short term, the situation is unlikely to improve, especially since the EU ETS carbon price has decreased since 2022, from EUR 97 per tonne of carbon dioxide produced in February 2022 to EUR 52 per tonne in February 2024 (Ember, 2024a). In the medium term, the introduction of the ETS2, newly including road transport and building, may bring a response to that, even if ETS prices remain volatile in the absence of carbon price floors. It is important for MS to accompany the increase in environmental taxation with measures to support vulnerable economic groups. This should be the role of the Social Climate Fund, created alongside the ETS2 implementation.

## Enabler 3: Shifting private finance towards climate-friendly financing

**Past progress:** There are currently no available indicators at the EU level that assess the alignment of the financial system with the EU climate neutrality target in a relevant way. Analysing only what exists in the banks' portfolios does not allow for an assessment of their potential to align with the Paris Agreement. What matters is how they plan to finance the decarbonisation of an economy that is still very carbon intensive. There is an urgent need for more transparency on how financial institutions are planning to better finance the transition. Sound transition plans are good instruments to do that (Elderson, 2024). However, these are still not disclosed publicly.

### Indicators:

- Share of banks with a sound transition plan
- Share of new banking loans aligned with the Paris agreement

**Policy context:** Several regulations have taken steps to make banking transition plans mandatory. The Corporate Sustainability Reporting Directive (CSRD), adopted in July 2023, obliges large companies and banks to either publish a sound transition plan by 2025 or indicate the deadline by which they will be able to do so. However, the CSRD now excludes banks' investments and lending activity from the scope of reporting (Green Central Banking, 2024), a change since ECNO's last assessment (ECNO, 2023). This reporting obligation could have further anchored the mandatory nature of the publication of transition plans. Finally, during a trilogue in December 2023, the Council, Parliament and European Commission came to a final agreement on the revision of the Capital Requirements Directive (CRD), which integrates the notion of prudential transition plans for banks. These transition plans should be consistent with the CSRD. By integrating the prudential supervision process, the soundness of banks' transition plans will be more closely monitored by supervisory authorities, such as the European Central Bank. The European Banking Agency (EBA) is expected to propose guidelines on the content and implementation of these banking transition plans in 2024.

**Areas of action:** Although legislative progress has been made on the obligation for banks to publish transition plans in recent years, nothing is certain yet. The timing of the publication of these plans is still unclear, as is their content, and the capacity of the public authorities to ensure their soundness and implementation. The EBA's guidelines still view banking transition plans as an instrument for risk management alone, with no real strategy for organising the financing of the transition. If these tools are to be effective in enabling banks to redirect their financial flows towards climate finance, it is essential that they are designed to do so. To this end, the EBA's guidelines should ensure that banking transitions plans are linked to European and national strategies, and to the transition plans of the corporates that banks finance. They could also ensure that the remuneration schemes are consistent with the implementation of the plan and that banking teams are sufficiently skilled and qualified to deal with climate issues (I4CE, 2024).



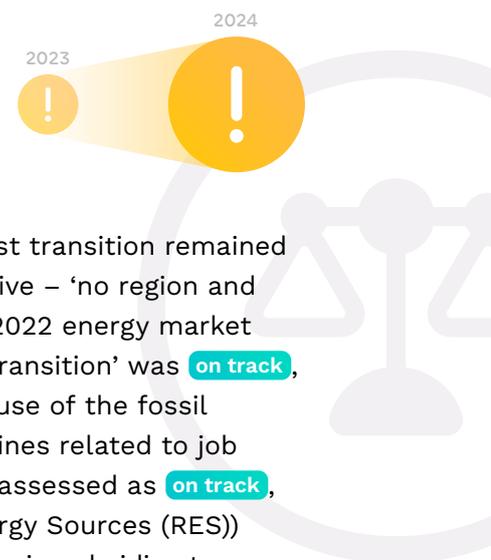
# Just and Inclusive Transition



## Too slow

Just transition refers to designing and executing the shift to climate neutrality in a fair and inclusive way. Job opportunities, regional policies, and managing distributional effects are essential to the process.

## 4.10 Just and Inclusive Transition



**Past progress:** The overall classification of the progress related to just transition remained **too slow** in the period assessed. Progress in the just transition objective – ‘no region and no individual left behind’ – was mixed, having been hindered by the 2022 energy market volatility. While the decline of the poverty rate in the ‘EU regions in transition’ was **on track**, the number of people in material deprivation increased in 2022 because of the fossil fuel energy crisis. The biggest encouragement stems from the trendlines related to job opportunities. The employment rate in ‘EU regions in transition’ was assessed as **on track**, with employment in the renewable energy sector (all Renewable Energy Sources (RES)) having soared in 2022. As the 2022 events also resulted in an increase in subsidies to vulnerable energy groups, we saw a reduction in the share of energy efficiency subsidies. Developments related to regional just transition policies were encouraging, with initial data signalling high absorption of regional policy funds.

**Policy context:** The EU policy landscape related to just transition constitutes an increasingly comprehensive framework. Its cornerstone in regions most affected by the transition is shaped by the support schemes under the Just Transition Mechanism, the Just Transition Fund (JTF), and the Just Transition Platform. The European Pillar of Social Rights Action Plan (EC, 2021a) supports well-functioning labour markets and social protection systems. It also outlines actions to be taken for the reduction of poverty. From 2026, the Social Climate Fund (SCF) will become operational and will provide dedicated funding to protect the vulnerable groups affected by the upcoming introduction of carbon pricing in the buildings and transport sectors. Other relevant political instruments are scattered across EU legislation, notably in the Fit for 55 package and in the National Energy and Climate Plans (NECPs).

**Areas of action:** To deliver the EU goals, it is crucial to effectively implement reforms outlined by the Member States (MS) in Territorial Just Transition Plans. This includes taking further action towards bridging the employment gaps and increasing job opportunities for workers from sectors affected. The improvement of labour market statistics and diagnosis of future demanded skills will be important keys to line up effective reskilling and upskilling programmes. On a national level, a focus is needed on a sound, knowledge-based preparation of Social Climate Plans (SCPs), which information about measures and investments realised using the SCF.

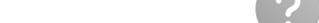
**Table 22: Progress in just transition towards the objective and enablers**

OBJECTIVE	ENABLERS		
Leaving no region and no individual behind 	Creating job opportunities 	Fostering regional just transition policies 	Supporting vulnerable groups with the right policy mix 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 23: Details on indicators' past progress and required change

2023 ▼	2024 ▶	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Leaving no region and no individual behind</b>						
 	Regional poverty rate [%]	2017–2022 (Eurostat, 2024n)	-2.1% per year	-0.5%-points per year	17.7% by 2030 (EC, 2021o)	-0.4%-points per year → on track
 	Average of four relevant sub-indicators in the material deprivation rate [%]	2017–2022 (Eurostat, 2024a, 2024i, 2024j, 2024k)	-0.6% per year	-0.1%-points per year	9.1% by 2030 (EC, 2021o)	-0.6%-points per year → 7.8 times faster
<b>ENABLER 1: Creating job opportunities</b>						
 	Employment in environmental goods and services [FTE]	2015–2020 (Eurostat, 2024e)	2.1% per year	36,686 FTE per year	n/a	n/a
 	Employment rate in regions [%]	2017–2022 (Eurostat, 2024d, 2024o)	0.7% per year	0.5%-points per year	78% by 2030 (EC, 2021o)	0.5%-points per year → on track
 	Employment in the renewable energy market [FTE]	2017–2022 (EurObserv'ER, 2023)	4.6% per year	63.431 FTE per year	n/a	n/a
<b>ENABLER 2: Fostering regional just transition policies</b>						
 	JTF progress implementation [%]	n/a	n/a	n/a	n/a	n/a
 	Share of accepted Territorial Just Transition Plans [%]	n/a	n/a	n/a	n/a	n/a
<b>ENABLER 3: Supporting vulnerable groups with the right policy mix</b>						
 	Share of support for energy efficiency purposes [%]	2017–2022 (EC, 2023ak)	-2.0%	-0.2%-points per year	n/a	n/a
 	Share of support for households [%]	2017–2022 (EC, 2023ak)	16.1%	2%-points per year	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Leaving no region and no individual behind

**Past progress:** In the period assessed, the just transition objective was moving in the **right direction**, but the reduction of the material deprivation rate still progressed **too slowly**. Some of the key factors driving the dynamics were the pandemic in 2020 and the Russian war in Ukraine starting in 2022 with the subsequent fossil fuel energy crisis. With regards to 'no region left behind', the share of people who are at risk of poverty or social exclusion in the EU's regions most affected by the energy transition continued to decrease in 2022, in line with reaching the EU's overall poverty reduction target. However, considering the wider impacts of the aforementioned crises the pace of that change slowed down in recent years. The material deprivation rate – a measure for 'no individual left behind' – increased in 2022 for all four categories considered, with the biggest rise in the inability to keep homes adequately warm. These changes were also largely caused by the impacts of the 2022 fossil fuel energy crisis. As an effect, the class of the indicator worsened. The changes were limited due to emergency policies and earlier progress in the energy transition.

### Indicators:

- Regional poverty rate
- Average of four relevant sub-indicators in the material deprivation rate

**Policy context:** In principle, all the major just transition areas are covered by EU policies. The main policy tools shaping the regional dimension of the just transition are the Territorial Just Transition Plans developed by MS. These define regions eligible for investments through the JTF and set out development needs and objectives for each region. The policy actions to protect the most vulnerable groups across the EU involved a range of protective measures to support consumers during the fossil fuel energy crisis, such as a windfall profit tax on excessive profits in the oil and gas sector, used to lower the prices for end users (EC, 2022h). The close-to-adoption electricity market design rule (EC, 2023j) foresees further protection of consumers in the long term, by making energy markets more resilient and energy bills more independent of short-term market volatility. The SCF will provide funding to protect vulnerable groups affected by the introduction of carbon pricing in the buildings and transport sectors. The SCF will be launched in 2026.

**Areas of action:** For the regional dimension of just transition, an important area of action is to review the spending of the JTF, to monitor its impact of the investments and to revise the eligible list of projects accordingly. Moreover, subsequent policy measures, which will be needed to be put in place after the projects relying on the JTF are finalised, should be strategically designed. This is particularly important as transition impacts will start affecting an increasing number of sectors. There is a need to initiate and develop just transition efforts in sectors such as transport, buildings and agriculture. In terms of the distributive effects, the key challenge is to move on from crisis management policies to more structural solutions and investments. The launch of the SCF is a step in this direction. Until the SCF becomes available in 2027, MS can already use the ETS' revenues and recovery fund to support vulnerable groups with measures other than protective actions.

## Enabler 1: Creating job opportunities

**Past progress:** Job opportunities in the EU increased in the period assessed, even if the pace of progress was still **too slow**. At 74.2% in 2022, the employment rate in the EU's most vulnerable regions was the highest recorded so far, **on track** to reaching the EU's overall employment goal of 78% among people aged 20 to 64 by 2030. However, as laid out in [5.4](#), significant inequalities between regions remain. Employment in the renewable energy sector (all RES) showed significant growth in 2022 (14.7% compared to 2021), and thus this indicator was almost assessed as **on track** – a significant change compared to last year's **far too slow** classification. Employment in environmental goods and services also saw a steady 2.1% increase over the period of 2015 to 2020, this however is still too slow. Thus, while the classifications of some of the indicators related to job opportunities were still too slow, recent trends show encouraging signs of improving momentum.

### Indicators:

- Employment in environmental goods and services
- Employment rate in regions
- Employment in the renewable energy market

**Policy context:** The Fit for 55 package will significantly impact the structure of the labour force between sectors, skillsets in demand, and regions. A crucial challenge is thus to bridge the emerging gap between existing skillsets and the qualifications in demand in the newly growing sectors. This issue is being addressed both at the EU level and through various initiatives by the MS. At the EU level, the primary source of legislation in this area is the European Skills Agenda (EC, 2020j), but relevant policy instruments are also scattered across many more policies, such as the Recovery and Resilience Facility (RRF), the Just Transition Fund to support for transitioning workers in the fossil fuel industry out of their jobs, revisions of directives under Fit For 55 (e.g. EPBD Directive) or NECPs. The European Pillar of Social Rights Action Plan plays a key role in setting employment-related objectives and introducing hands-on policies such as the Effective Active Support to Employment (EASE).

**Areas of action:** EU policy-makers must ensure the timely development of the skills needed for the transition to climate neutrality. The first step in this direction should be a state-led systemic gathering of precise data on shortages of skilled professionals in each profession and the use of this data to create adequate training programmes (SolarPower Europe, 2023). Existing policies regarding (green) job creation require more ambitious targets, especially in terms of their timeline and pace of progress. Furthermore, it is crucial to track the implementation and to measure the effectiveness of policies introduced in the last few years.

## Enabler 2: Fostering regional just transition policies

**Past progress:** In 2023, Bulgaria's Territorial Just Transition Plan was accepted by the EC, which means that all MS have now identified their 'regions in transition' and outlined the policies for targeted support of these areas. Payments for this support from the JTF started in 2022. Data regarding the amount of money accessed already by MS indicate that, as of March 2024, over 30% of the total allocation has already been distributed (EC, 2024a). This number is consistent with the linear trend to attaining 100% spending in 2030. It is worth noting that usually the pace of spending of EU funds is significantly slower in the first three years compared to the first three years of the JTF (e.g., in the case of the European Regional Development Fund from 2014 to 2020). This signals a positive development of the expected high absorption of EU just transition funds but also carries a risk of financial resources running out before 2030 if the amount available is not increased in the future. Of course, spending is just an initial step in supporting the most vulnerable regions – in the years to come, it will be crucial to monitor impacts of the projects realised using JTF financing.

### Indicators:

- JTF progress implementation
- Share of accepted Territorial Just Transition Plans

**Policy context:** The main policy instrument that supports progress on just transition in the EU regions is the Just Transition Mechanism (JTM). The Mechanism is designed to address challenges experienced by the most vulnerable regions, industries, and workers. The financing options available within the JTM framework consist of three funds: The JTF (amounting to over EUR 19 billion, and expected to mobilise around EUR 25.4 billion in investments total), the InvestEU 'Just Transition' scheme (a budgetary guarantee scheme expected to mobilise EUR 1015 billion in mostly private sector investments) and a Public Sector Loan Facility (combination of grants from the EU budget with loans from the European Investment Bank expected to mobilise EUR 18.5 billion of public investment). The largest part of the JTM funding will be distributed through the JTF. The JTF will support economic diversification and reconversion of relevant regions through investment, e.g., in reskilling and upskilling of the workers, support of small and medium enterprises, creation of new firms, and research and innovation. The JTM funding is complemented by the Just Transition Platform, which constitutes a single access point and helpdesk for relevant authorities and beneficiaries of the JTF, where they can find comprehensive technical and advisory support. The Platform's role is also to promote the exchange of best practices among stakeholders.

**Areas of action:** The most important area of action for EU regions is the effective implementation of the policies outlined in the Territorial Just Transition Plans. Special attention should be paid to reskilling and upskilling efforts (especially adequate identification of labour market gaps), the effectiveness of a fossil fuel phase-out (with special attention paid to a people-centric approach in this respect) and better integration of distributional considerations into the implementation of the Polluter Pays Principle.

## Enabler 3: Supporting vulnerable groups with the right policy mix

**Past progress:** Progress with an overall policy mix to support vulnerable groups was mixed in the assessed period. The energy market volatility of 2022, which was a consequence of the Russian invasion of Ukraine, brought significant, but divergent, changes in both the share of energy subsidies distributed to households and the share of support dedicated to the improvement of energy efficiency. Even though the rate of funds distributed to households almost doubled between 2021 and 2022, this was almost entirely due to direct fossil fuel subsidies. While energy efficiency support also grew in the same period, its share dropped as a result of this overall increase. The first indicator is thus assessed as **on track** but is anticipated to decrease in pace as the emergency fossil fuel subsidies will be ending in full; the other was moving in the **wrong direction** and needs a course correction, also to increase the resilience for future energy price volatility.

### Indicators:

- Share of support for energy efficiency purposes
- Share of support for households

**Policy context:** The strategic EU regulatory framework for this area is based primarily on the aforementioned instruments: JTM, JTF and – in the near future – SCF. National strategies are stipulated in the NECPs, which since 2022 have to include a report on the progress made by the MS towards phasing out energy subsidies, in particular for fossil fuels. Policies that support vulnerable groups are also outlined in the RRF. Recent policy measures undertaken by MS in order to support the most vulnerable groups were, to a large extent, temporary schemes put in place to protect EU consumers from the high prices after the 2022 fossil fuel energy crisis. Across the EU, at least 230 temporary national measures were created or extended to address the situation, and households were their main direct beneficiaries, receiving EUR 58 billion out of estimated EUR 181 billion spent for this purpose (EC, 2023ak). The amount of funds necessary to cushion the 2022 shock was contained by earlier progress in the energy transition. To further the resilience delivered by the transition, emergency measures that have been maintained in the medium term should now get redirected to actively support the transition (e.g., the build-out of renewables and energy efficiency).

**Areas of action:** For progress to be made in this area it is crucial to move on from temporary protection instruments to structural measures to manage distributional effects, designed to gradually make vulnerable groups independent of specific funding. If temporary measures continue to be extended further in the longer term, this could result in negative impacts such as lowering market incentives for energy efficiency and renewable energy investments (including clean heating solutions) and redirecting funds that would otherwise be spent on necessary structural investments. National authorities should therefore focus on a sound, knowledge-based preparation of Social Climate Plans, to make sure that the money available through the SCF is spent effectively.



# Governance



**On track**

Governance refers to the institutions, procedures, and frameworks used by governments to manage and guide policy-making and foster societal buy-in for the transition to climate neutrality.

## 4.11 Governance



Climate governance refers to the tools used by governments to manage policy-making and foster societal buy-in to the changes needed on the path to climate neutrality. More so than other building blocks, the assessment of progress on climate governance included Member State (MS) specific data and developments.

**Past progress:** Overall, the governance building block remained **on track**, with no change in the progress classification compared to last year's report. The introduction of five new indicators this year added analytical depth but did not change the overall outlook. This cautiously optimistic assessment is based on continued positive trends in the growth of frameworks and institutions at national level, such as climate laws and scientific advisory bodies. The increased use of green budgeting by MS and the sectoral expansion of strategic climate planning at EU level signify efforts towards a consistent, all-of-government approach. However, shortcomings in the implementation of key governance mechanisms risk hindering future efforts if left unaddressed. Among these are inadequate fulfilment of EU planning and reporting requirements, both in terms of substance and timeliness; underused and undeveloped long-term strategies; limited national ownership of robust progress monitoring tools; and a lack of transparency on the effectiveness of participation in climate policy-making. Public awareness of climate change and support for government action remained high over the period assessed, but survey data also showed a lack of confidence in national measures. Indicators further revealed little growth in subnational support as evidenced by a slowdown in new signatories to the Covenant of Mayors and only marginal uptake of robust net zero targets by large EU companies.

**Policy context:** Climate governance in the EU is defined by a combination of policies directed at EU institutions, EU-level obligations on MS, and the strength of national systems themselves. All three have been further expanded and specified over the period from 2019 to 2023. The 2021 EU Climate Law outlines an all-economy framework for target-setting and monitoring progress at EU level, and the Governance Regulation (GovReg) adopted in 2018 includes a range of common national governance requirements related to planning, reporting, and participation, which integrate various energy and climate policy aspects. Also relevant, the Aarhus Regulation enshrines standards for access to information, access to justice, and public participation in climate policy at both EU and national levels. It was revised in 2021 to substantially widen the scope of EU decisions subject to internal review as well as scrutiny by NGOs and individuals. These policies coupled with the rapid build-out of legal frameworks and institutions at national level form a promising foundation for managing the net zero transition – but this comes with an important caveat. To ensure effective climate policy-making, existing frameworks and governance instruments must be implemented to their full potential. At the same time, high-profile conflicts, such as the debate surrounding Germany's phase-out of fossil-fuel heating and farmer protests across Europe, point to growing politicisation of climate issues and underscore the need for increased governmental attention to inclusive and meaningful participation by stakeholders and the public.

**Areas of action:** Considering advancements in the overall legal framework, the robust implementation of existing EU requirements is of particular importance. This includes the development of timely and sufficiently detailed long-term strategies (LTS), actionable national energy and climate plans (NECPs), comprehensive biennial progress reports (NECPRs), and permanent multi-level climate and energy dialogues as well as meaningful participation in the creation of plans. EU-level policy action could consider dedicated support to MS for implementation, further specification of the legal requirements, and stricter follow-up to ensure adherence. Overall, EU and national climate governance should re-emphasise the importance of long-term planning, ensure NECP and LTS alignment, both structurally and in practice (not just on paper), and provide a clear vision of what net zero means at the EU level and in each national context. Better practice on stakeholder and public participation in climate policy and transparency on the effectiveness of consultations serve to boost public and political support. Notably, the 2024/2025 review and potential revision of the GovReg and EU Climate Law offers a window of opportunity to streamline and improve the governance system further and strengthen implementation.

**Table 24: Progress on governance towards the objective and enablers**

OBJECTIVE	ENABLERS		
Establishing and implementing a comprehensive framework and fostering societal buy-in	Providing a clear vision and accountability	Ensuring a consistent, all-of-government approach	Promoting meaningful stakeholder and public participation

Note: Large circles show the progress classification of this year and small circles the one from last year's progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information. Source: ©ECNO.

**Table 25: Details on indicators' past progress and required change**

2023 2024 >	Historical data			Required change	
	Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Establishing and implementing a comprehensive framework and fostering societal buy-in</b>					
Adoption of climate framework laws at national level [% of EU GHG emissions covered]	2018-2023 (Ecologic Institute, 2024; EEA, 2023b; Evans et al., 2024; GRI, 2023)	21% per year	9%-points per year	n/a	n/a
Thorough implementation of EU governance requirements at national level	n/a multiple studies	n/a	n/a	n/a	n/a
Public support for and confidence in the transition to climate neutrality [% of EU population]	2013-2023 (Eurobarometer, 2023b)	-0.9% per year	-0.8%-points per year	n/a	n/a

		Historical data			Required change		
2023	2024 >	Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.	
		EU cities committed under the Covenant of Mayors [% of EU population]	2017–2022 (Covenant of Mayors, 2023; Eurostat, 2023h)	2% per year	0.8%-points per year	n/a	n/a
		Science-based climate neutrality targets in large EU companies [number of companies]	2018–2023 (SBTi, 2023)	1129% per year	13 companies per year	n/a	n/a
<b>ENABLER 1: Providing a clear vision and accountability</b>							
		Up-to-date and compliant long-term strategies (LTS) at national level [% of EU GHG emissions covered]	2018–2023 (EC, 2023y; Velten et al., 2022)	100% per year	10%-points per year	n/a	n/a
		National progress monitoring that can trigger additional action [% of EU GHG emissions covered]	2018–2023 (Ecologic Institute, 2024; EEA, 2023b; Evans et al., 2024; GRI, 2023)	19% per year	6%-points per year	n/a	n/a
		Independent scientific advisory bodies at national level [% of EU GHG emissions covered]	2018–2023 (Ecologic Institute, 2024; EEA, 2023b; Evans et al., 2024; GRI, 2023)	27% per year	9%-points per year	n/a	n/a
<b>ENABLER 2: Ensuring a consistent, all-of-government approach</b>							
		Green budgeting practices at national level [% of EU GHG emissions covered]	2020–2023 (EC, 2023r; EEA, 2023b; OECD, 2020)	11% per year	4%-points per year	n/a	n/a
		Up-to-date strategic climate planning at EU level [number of policy areas covered]	2018–2023 (EC, 2023n; GRI, 2023)	13% per year	1 building block per year	n/a	n/a
<b>ENABLER 3: Promoting meaningful stakeholder and public participation</b>							
		Citizens' climate assemblies at national level [% of EU GHG emissions covered]	2018–2023 (EEA, 2023b; KNOCA, 2023)	32% per year	4%-points per year	n/a	n/a
		Quality of public and stakeholder consultations on EU climate policy impact assessments [index 1–4]	n/a (RSB, 2022)	n/a	n/a	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; see Table 35 for further information. n/a indicates that data are not available. To control for year-to-year variation in emissions, shares are calculated from 2015 data and remain static over the period for using EU GHG emission coverage.

Source: ©ECNO.

## Objective: Establishing and implementing comprehensive frameworks and fostering societal buy-in

**Past progress:** Progress towards the objective for Governance was found to be a mixed picture (see Table 24). From 2018 to 2023, the share of EU GHG emissions covered by national climate laws rose 21% annually, from 14% to 61%. However, this positive trend for overarching legal frameworks was countered by evidence suggesting the implementation of EU governance requirements at national level was **far too slow**, especially regarding the timeliness and quality of draft NECP updates. On societal buy-in, public awareness of climate change and support for EU climate neutrality remained **on track** at 83% in 2023. But another crucial message arising from the survey data was that 67% of EU citizens viewed their country's governmental action as inadequate. Progress on subnational and private sector support was found to be **too slow**. Signatories to the Covenant of Mayors for Climate and Energy by EU cities and towns, covered only 44% of the EU population in 2022, with marginal 2% annual growth from 2017 to 2022. In 2023, 26 or roughly 10% of EU companies on Fortune's Global 2000 list had a net zero target validated by the Science Based Target initiative (SBTi). This was up from one in 2021 (when the standard was launched), and although the spread of corporate net zero targets is likely to pick up in the coming years, it still represented only a fraction of large European businesses.

### Indicators:

- Adoption of climate framework laws at national level
- Thorough implementation of EU governance requirements at national level
- Public support for and confidence in the transition to climate neutrality
- EU cities committed under the Covenant of Mayors
- Science-based climate neutrality targets in large EU companies

**Policy context:** Legal frameworks help manage the transition by enshrining objectives and institutional means to meet them (Averchenkova et al., 2024; Dubash et al., 2021). While the EU Climate Law provides a Union-wide foundation for climate neutrality, laws have also spread at a national level, with new efforts and revisions in Bulgaria, Estonia, Latvia, the Netherlands, Romania, Slovenia, and Slovakia indicating continued momentum (Duwe & Evans, 2020; Ecologic Institute, 2024). Still, frameworks on paper are insufficient if they do not lead to the implementation of robust governance practices. In 2023, many EU countries were late submitting draft NECP updates, and the assessment of the 21 available plans found ambition gaps and missing clarity on socio-economic impacts (EC, 2023g). Further deficiencies include: internal inconsistencies on issues, such as bioenergy and residual emissions (ECNO, 2024c); overlooked territorial and distributional effects (Kögel, 2024; Niewiata-Rej, 2023); variable information quality (CAN-E, 2023; Duwe et al., 2019); and weak public engagement (Didi et al., 2023; EEB, 2023b, 2023a; Energy Cities, 2020). Only eight countries met the March 2023 deadline for the submission of the first NECPs (EC, 2023d). Together these weaknesses in implementation may result in an incomplete information base and thus impact the validity of the EU's own monitoring.

**Areas of action:** Achieving EU climate neutrality requires national ownership of the transition (Kulovesi et al., 2024). Gaps in implementation at the national level could be addressed by ensuring timely and sufficiently detailed national planning and reporting submissions to the EU and their transparent review (ESABCC, 2024; Oberthür et al., 2023). Refining NECP/LTS submission templates and further guidance on making planning tools consistent with net zero could enhance the alignment between short- and long-

term planning (Duwe et al., 2022; ECNO, 2024a; Evans et al., 2023; Velten et al., 2022). Finally, renewed attention to meaningful participation (see also [Enabler 3](#)) could galvanise societal support and pre-empt the growing politicisation of climate issues in EU society by boosting the perceived fairness and legitimacy of state actions (Bergquist et al., 2022; Fisher et al., 2022).

## Enabler 1: Providing a clear vision and accountability

**Past progress:** Progress towards establishing a clear vision and accountability mechanisms for reaching climate neutrality was **too slow** in the period assessed. In 2023, only 43% of EU GHG emissions were covered by an up-to-date LTS at the national level that was fully compliant with the mandatory content requirements set in EU law. While many MS have a system for monitoring progress that goes beyond EU obligations, commonly in the form of an annual report, mechanisms with a built-in course correcting provision (a so-called ‘action trigger’) were limited to only five countries. Positive developments in the spread of scientific advisory bodies include a new institution in Slovenia and a new legal provision for mandated policy input by the existing council in Greece. Although, six national independent scientific advisory bodies were established between 2018 and 2023, delayed implementation, e.g., in Spain, points to difficulties in getting some new institutions operational.

### Indicators:

- Up-to-date and compliant long-term strategies (LTS) at national level
- National progress monitoring that can trigger additional action
- Independent scientific advisory bodies at national level

**Policy context:** The GovReg enshrines several common national governance requirements that serve as ‘baseline’ standards for planning and progress reporting in MS. Still, non-compliance and delays underscore shortcomings, especially on long-term planning. Poland has yet to officially submit an LTS and over a third of strategies fail to cover the mandatory content outlined in Article 15.4 of the GovReg. Information commonly missing includes detail on removals and sectoral pathways, a lack of clarity on socio-economic impacts, and investment needs (Velten et al., 2022). The Czech and German strategies pre-date the GovReg and thus are out-of-date, and soon even LTSs submitted in 2020 may be too old to serve as valid national blueprints for the net zero transition. This presents a risk as not all countries plan to follow the optional five-year cycle for updates (Evans et al., 2024). Article 15.6 of the GovReg requires national LTSs to be consistent with EU-wide climate neutrality, which could result in stronger strategies in the future. However, it is unclear how countries are supposed to check for this, due in part to the lack of an updated EU LTS, which would lay out what climate neutrality means across the EU economy and thus serve as a benchmark for assessing the consistency of national strategies (Duwe, 2022). On scientific advice, the EU Climate Law invites MS to adopt independent advisory bodies, and the EU’s own institution, the EU Scientific Advisory Board on Climate Change (EU Advisory Board) has recommended these be made mandatory at the national level (ESABCC, 2024).

**Areas of action:** Moving forward, EU governments would benefit from (re)emphasising the importance of regular updates to a long-term vision for climate neutrality – as recognised at international level in the Glasgow Climate Pact under the Paris Agreement. Moreover, the continued spread of independent scientific advisory bodies and dedicated national monitoring mechanisms could help ensure the scientific robustness and accountability

of policies in countries that do not have these in place already. Potential areas of action include more frequent updates and a review process for LTSs (as for NECPs), as well as technical capacity building at national level (Duwe, 2022; ESABCC, 2024; Oberthür et al., 2023). National progress monitoring could benefit from greater transparency at the EU level, especially on the consistency of national measures with EU climate neutrality (per Art. 7 of the EU Climate Law), which was omitted from the EC's 2023 report (ECNO, 2024a). Scientific advisory bodies should be equipped for impact via mandated policy input, adequate resources, and a legal requirement for government to respond (Averchenkova et al., 2018; Evans & Duwe, 2021). The EU Advisory Board could play an important role in this context by encouraging the uptake of good practice and engaging with national counterparts. Short of requiring countries to adopt scientific advisory bodies, national climate planning could be improved through EU guidance or support to implement an 'independent scientific review', e.g., by national universities or research organisations.

## Enabler 2: Ensuring a consistent, all-of-government approach

**Past progress:** This year's assessment introduces new underlying indicators on national green budgeting and EU-level strategic climate planning. Green budgeting tools help align public spending with climate objectives, while strategic climate planning mainstreams a vision for climate neutrality across sectoral and cross-cutting policy areas.

Indicator data suggested that the EU and MS were **on track** towards a consistent, all-of-government approach to the climate neutrality transition. EU GHG emissions coverage from countries using green budgeting rose from 37% in 2020 to 50% in 2023, a 11% annual growth rate. Additionally, the EC's strategic planning for key policy areas advanced, adding an average of one new policy area (i.e., ECNO building block) per year from 2018 to 2023.

**Policy context:** The transition to climate neutrality encompasses the full economy and thus requires a consistent, all-of-government approach to align decision-making. While the 2018 GovReg brought about the closer integration of climate and energy policy, the European Green Deal can be seen as the culmination of years of climate policy integration (CPI) in the EU, positioning climate neutrality as a guiding objective across all EU policy areas (Oberthür & Von Homeyer, 2023). Consequently, additional mechanisms were established through the EU Climate Law to further enhance integration, such a requirement for the EC to assess the consistency of existing EU and national measures with climate neutrality, as well as the consistency of all new EU measures (EU Climate Law, Art. 6 and 7). These assessments could help safeguard an all-of-government approach, but they are infrequent (every five years) and lack transparent reporting, which could limit their effectiveness in practice (Evans et al., 2023). The first ex post assessment of existing measures was due in 2023 but did not result in a publicly available report, and in 2022, only 57% of relevant impact assessments for new Union measures performed the required check for net zero consistency (RSB, 2022, tbl. 3). On green budgeting, the EU has dedicated EUR 670 billion (in 2022 prices) to the transition, requiring at least 30% of public spending flow into climate ([see also 4.9](#)). The Sustainable Finance Strategy and Taxonomy provide guidance on aligning spending (EC, 2021d), and the EU Green Budgeting Reference Framework (GBRF) promotes the widespread adoption of

### Indicators:

- Green budgeting practices at national level
- Up-to-date strategic climate planning at EU level

national green budgeting as a tool for mainstreaming of climate in public finance (EC, 2022e). The GBRF evaluates progress using a tiered development system, offers guidance on best practices, and facilitates exchange between MS. In 2023, 12 countries already employed green budgeting, with Cyprus, Czechia, Lithuania, Romania, and Slovenia intending to adopt practices in the future (EC, 2023r).

In parallel, strategic climate planning at the EU level was strengthened over the period assessed. In 2023, some form of EU strategy focused on climate had been published for 10 of ECNO's 13 sectoral and cross-cutting policy areas, or building blocks, of a climate neutral future. Among those policy areas missing a comprehensive EU strategy for the transition were just transition, lifestyles, and governance. Industry, buildings, CDR, finance, and external action were evaluated as 'partially' covered, with existing policy plans lacking information on important aspects of the transition in each respective policy field. Notably, the EU Carbon Management Strategy published in early 2024 and thus omitted from the current analysis, is a sign of further progress on CDR-related strategic planning.

**Areas of action:** The continued elaboration of strategic planning at the EU level across all relevant policy areas facilitates consistency, but strategies and plans need to be updated regularly to account for economic and technological developments. Moreover, sectoral policy planning alone does not guarantee an integrated approach. Regular updates to the EU LTS would not only provide an opportunity for dialogue, engaging all relevant areas of the economy, but also a top-down vision for climate neutrality to serve as guidance for NECP and national LTSs (Duwe, 2022). The new consistency mechanisms under the EU Climate Law are a promising tool to align policies at both the EU and national levels, but enhanced transparency in reporting could ensure impact. At the national level, analysis by ECNO showed that MS should pay closer attention to sector interactions to ensure internal consistency in NECPs (ECNO, 2024c). On green budgeting, technical capacity shortages identified by national officials call for increased training and support (EC, 2023r).

### Enabler 3: Promoting meaningful stakeholder and public participation

**Past progress:** Progress towards meaningful public and stakeholder participation was found to be partially **on track** but difficult to assess, with no change from the previous assessment. From 2018 to 2023, six national climate assemblies were convened in countries covering roughly 21% of EU GHG emissions (KNOCA, 2023). The Irish assembly, which ran from 2016 to 2018, was omitted from analysis for being older than five years. Despite the low number, this represents a positive **on track** trend given the novelty of these institutions in the EU. While all assemblies included in the analysis came with a clear mandate, only half saw a governmental response or had an outreach and communications strategy (see Rovers & Dejaeghere, 2022). Moreover, the degree to which EU MS will continue to pursue assemblies is unclear, as is the extent to which they will be integrated into governance systems with any regularity. To date, all national examples have been one-off occurrences. As with last year's report, the quality of stakeholder consultations on climate policy impact assessments at the EU level was not

#### Indicators:

- Citizens' climate assemblies at national level
- Quality of public and stakeholder consultations on EU climate policy impact assessments

possible to measure due to data gaps in 2016 and 2019 and the absence of detailed data on consultation quality, which is bundled with a broader evaluation of the information base (for more detail see ECNO, 2023). Furthermore, a lack of distinction between policy areas means it is not possible to know if trends are unique to climate measures. Nonetheless, the EU Regulatory Scrutiny Board has singled out the ‘unbalanced inclusion of stakeholder feedback’ as a shortcoming in the implementation of impact assessments generally (RSB, 2022).

**Policy context:** Frequent, early, and effective participation in climate policy decisions is a crucial enabler for societal buy-in and consensus on climate neutrality. At the EU level, Article 9 of the EU Climate Law obliges the EU to engage ‘all parts of society’ by leveraging national processes as well as the European Climate Pact for ongoing engagement with stakeholders at national and local levels (EC, 2020i). However, it stops short of requiring any specific actions. At the national level, the GovReg requires MS to conduct public consultations during the development of their NECPs and LTS (Article 10) and calls for the establishment of permanent ‘multi-level climate and energy dialogues’ (Article 11). Both the EU and its MS are party to the Aarhus Convention, and the Aarhus Regulation, amended in 2021, establishes standards for public participation and access to information on environmental policy-making. Despite these policies, studies point to weak practices at the national level (Didi et al., 2023; Duwe et al., 2019; EEB, 2023a; Velten et al., 2022), and others have raised concerns over transparency, citing a lack of reporting detail on the implementation of the multi-level climate and energy dialogues (Faber et al., 2024). In 2022, the EU itself recognised the need to improve the implementation of Aarhus rights (EC, 2022b). In short, the indicators used in ECNO’s assessment present only a narrow picture, and while evidence points to the need for improvements, data limitations make a more comprehensive assessment challenging.

**Areas of action:** Effective and ongoing public and stakeholder engagement takes time and resources. Improving national implementation may require additional funding and capacity building. More detailed and transparent national reporting on the effectiveness of existing practices could help pinpoint areas for targeted EU support. From a policy perspective, observers have called for the anchoring of Aarhus rights more concretely in the GovReg (Robert, 2023) and expanding the role of the multi-level dialogues to promote better national practice (Oberthür, 2024). The EC could also provide more concrete follow-up and engagement with MS on how they implement these mechanisms. All channels for public engagement should be designed and organised for impact with adequate political attention to follow up, otherwise these risk being dismissed as ‘citizen-washing’ (EEB, 2022). Finally, the quality of EU-level consultation processes is unclear due to data constraints, indicating a need for improved reporting and transparency on their effectiveness.



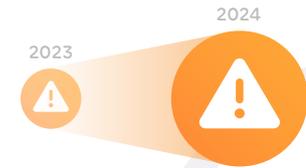
# Adaptation



**Far too slow**

Climate adaptation is necessary to respond to unavoidable climate impacts. It requires implementing effective adaptation measures on the ground as well as supportive governance and financial frameworks.

## 4.12 Adaptation



**Past progress:** The development of adaptation in the EU continued to be **far too slow** in the period assessed, with no change to the progress classification of the last year. This is primarily due to key indicators towards the objective of becoming a climate resilient society having moved in the **wrong direction** – economic losses from climate related extremes, for example, have been increasing at an average rate of EUR 6 billion per year – while a notable lack of data surrounding key enablers and other indicators remained.

**Policy context:** An updated Adaptation Strategy was launched in 2021 to present a long-term vision for EU adaptation and climate resilience by 2050. This strategy, and the implementation and achievement of its objectives at the EU and Member State (MS) level, should support progress on adaptation within the bloc. Adaptation is further considered at the sectoral level through e.g. Water Framework Directive, Biodiversity Strategy, etc. At the MS level, adaptation governance is operationalised through national adaptation policies. Although these aim to formalise the actions being taken at the national and sub-national level, the approaches have a range of content and scopes, and monitoring and reporting efforts remain patchy. The hope is for the EU Adaptation Strategy (EC, 2021f) to enhance the coordination and harmony between national approaches. The EU’s Governance Regulation outlines reporting requirements through National Energy and Climate Plans (NECPs), however requirements related to adaptation remain high-level. This is also true for adaptation finance tracking and reporting. Given that the Adaptation Strategy remains relatively new, and that guidelines on effective national approaches are still in development, more progress on adaptation is expected in the coming years.

**Areas of action:** To support a climate-resilient society and to achieve the aims of the EU Adaptation Strategy, there is an urgent need for improved data. Basic data on implementation should be enhanced through approaches to track and measure the effectiveness of actions at achieving their resilience objectives. Similarly, information on implementation of certain adaptation plans, and it is important that this continues to be updated; could be enhanced through qualitative evaluation. Improving the data on monitoring, reporting, and evaluation (MRE) in adaptation plans would help in assessing the degree to which plans are being regularly updated. Finally, information on adaptation finance needs significant improvement and streamlining. MS are encouraged (though not required) to develop adaptation budgets. Harmonising the approach to reporting on adaptation actions as well as finance would enable a more comprehensive assessment on the state-of-play of adaptation in the EU.

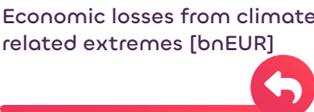
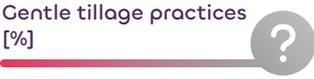
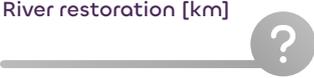
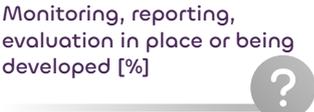
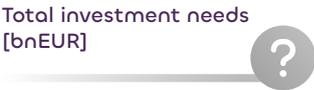
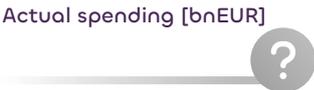
**Table 26: Progress on adaptation towards the objectives and enablers**

OBJECTIVE	ENABLERS		
Becoming a climate resilient society 	Implementing adaptation actions 	Setting up robust adaptation governance 	Financing adaptation 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 27: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Becoming a climate resilient society</b>						
 ND-GAIN country index [score out of 100]		2016–2021 (University of Notre Dame, 2023)	-0.02% per year	-0.01 index per year	n/a	n/a
 Economic losses from climate-related extremes [bnEUR]		2017–2022 (EEA, 2023a)	21% per year	6.0 bnEUR per year	n/a	n/a
<b>ENABLER 1: Implementing adaptation actions</b>						
 Green urban areas [%]		2018 (EEA, 2022b)	n/a	n/a	n/a	n/a
 Gentle tillage practices [%]		2010–2016 (EUROSTAT, 2020)	n/a	n/a	n/a	n/a
 River restoration [km]		n/a	n/a	n/a	n/a	n/a
<b>ENABLER 2: Setting up robust adaptation governance</b>						
 National adaptation policy in place [%]		2018–2023 (EEA, 2023d)	2.0% per year	1.9%-points	n/a	n/a
 Monitoring, reporting, evaluation in place or being developed [%]		2023 (EEA, 2023e)	n/a	n/a	n/a	n/a
<b>ENABLER 3: Financing adaptation</b>						
 Total investment needs [bnEUR]		n/a	n/a	n/a	n/a	n/a
 Total planned expenditure [bnEUR]		n/a	n/a	n/a	n/a	n/a
 Actual spending [bnEUR]		n/a	n/a	n/a	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Becoming a climate resilient society

**Past progress:** From 2016 to 2022, progress on both topline indicators for progress on adaptation was moving in the **wrong direction** (see [Table 26](#)), with little changes to last year's assessment: The average score of EU countries on the University of Notre Dame's Global Adaptation Initiative (ND-GAIN) index was nearly constant, with a slight downward trend between 2016 and 2021. While there remained a wide range of scores at the country level, to meet the objective of building a resilient society, this indicator needs to be increasing rapidly both at the country and EU level. Meanwhile, economic losses from climate-related extremes were increasing, with a change of 6 billion EUR per year between 2017 and 2022. These losses were the result of a combination of factors: more frequent, intense, and thus costly climatic events because of increasing global warming; more exposed and therefore vulnerable infrastructure and populations; and varying levels of disaster preparedness.

### Indicators:

- ND-GAIN country index
- Economic losses from climate-related extremes

**Policy context:** The EU Adaptation Strategy (EC, 2021f) presents a long-term vision to adapt to the impacts of climate change and become climate resilient by 2050. The strategy includes 49 actions split along four key objectives: smarter adaptation, faster adaptation, more systemic adaptation, and stepping up international action for climate resilience. Specifically, to reduce damages from climate-related extremes, the strategy calls for increased investment in resilient, climate-proof infrastructure, improved disaster risk reduction and prevention strategies, and improved coordination and coherence on standards, guidelines, targets, and knowledge. It also links directly to EU-focused initiatives such as the sustainable finance efforts (including the EU taxonomy on sustainable activities), as well the EU Mission on Adaptation. Reporting on adaptation is required every two years according to the Governance Regulation. Adaptation is further included in sectoral policies, such as the Biodiversity Strategy, Common Agricultural Policy, Farm to Fork Strategy, Water Framework Directive, and the Covenant of Mayors.

**Areas of action:** Effective implementation and achievement of the aims of the EU Adaptation Strategy will be an important step. Significantly increased investment in climate-proof infrastructure and disaster risk reduction will be critical in reducing the economic damage caused by extreme events. National governments have an important role to play here, ensuring that their adaptation policies are based on up-to-date climate risk assessments, and including a coherent, comprehensive approach to developing and implementing adaptation actions. MS would also benefit from developing clear adaptation budgets, as well as ensuring cross-sectoral synchronicity with regards to planned actions. Finally, MRE practices are still lacking in many MS. These should be an area of focus in the coming year to ensure that adaptation progress is tracked and regularly updated. At the EU level, there is an urgent need for improved data and information. This is true both for on the ground actions (e.g. kilometres of rivers restored) as well as high-level policy and financial information (e.g. funds earmarked for adaptation measures). Providing such data will allow for a clearer picture on adaptation progress in Europe. The first European Climate Risk Assessment (EEA, 2024a) is a promising step towards an improved understanding not only of climate risks, but also the resilience needs in Europe.

## Enabler 1: Implementing adaptation actions

**Past progress:** Progress on adaptation actions remained difficult to assess, largely due to a lack of data. The previous report assessed adaptation across the dimensions of greening cities, adapting agriculture and forestry, and blue measures. In this report, we selected one indicator to represent each of these dimensions. With regards to urban adaptation, there remained a strong lack of data, with the share of green urban areas still containing only one data point for 2018. Data for gentle tillage practices in agriculture remained unchanged, with the most recent data coming from 2016, at which point the trend was heading in the **wrong direction** since 2010. Finally, for blue measures, there continued to be no data on kilometres of rivers restored to a free-flowing state. The EU Biodiversity Strategy set out a target to restore 50,000 km of free-flowing rivers by 2030, however there appears to be no monitoring of progress towards this goal.

### Indicators:

- Green urban areas
- Gentle tillage practices
- River restoration

**Policy context:** At the EU level, adaptation action is described from a high-level perspective in the EU Adaptation Strategy, which lays out objectives and guiding principles for application in MS (e.g. promoting nature-based solutions, improving data availability). The more 'on-the-ground' aspects of adaptation, as tracked under this enabler, will generally be outlined in national, local, regional, and sectoral policy documents (such as a national adaptation strategy, urban planning documents, or a river basin management plan). Increasing the coherence between these documents can help improve the effectiveness of adaptation actions. Monitoring, reporting, and evaluation also plays an important role in ensuring that adaptation actions are achieving their objectives. The Adaptation Strategy also links to the Mission on Adaptation, which supports EU regions, cities, and municipal authorities in implementing adaptation and building resilience. The Governance Regulation established rules for planning, reporting, and monitoring. Though primarily focused on mitigation and energy, the regulation also covers reporting on adaptation, including plans and strategies as well as monitoring and evaluation frameworks.

**Areas of action:** Generally, adaptation actions will be implemented at local and regional levels, given the highly contextual nature of the implementation. However, there is currently no comprehensive reporting on what can be perceived as 'best-practice' adaptation that could apply across spatial scales. In addition to the importance of local contexts, this is also due to a lack of experience surrounding needs and the effectiveness of adaptation responses. MRE is a critical area of action for tracking progress in adaptation actions. Effective MRE relies not only on qualitative assessment and reflection, but also data. There is a notable lack of data tracking adaptation actions in the EU and MS at the national, regional, or local level. Land cover and land use information is available through the EEA's 'Urban Atlas' datahub, but is only updated every six years, and remains challenging to access and evaluate. Data on EU-level objectives, such as the river restoration target, should also be readily available. The adoption or updating of EU standards or norms would also be a positive development. Adopting the EC (2023t) guidelines aiming to harmonise national adaptation strategies and plans will enable improved assessment of adaptation actions in the EU.

## Enabler 2: Setting up robust adaptation governance

**Past progress:** There was notable progress on adaptation governance in the period assessed, as the topic reached the mainstream in the last decade or so. The adoption of the new EU Adaptation Strategy in 2021 was an important development, laying out a clear framework to accelerate and improve adaptation implementation across the EU by 2050. It is a positive sign that all EU MS have a national adaptation policy document in place. Some MS have even begun developing regional and sectoral adaptation plans, though they remain a minority. With only one data point, it was harder to identify a trend in the adoption of MRE practices. However, as these form integral parts of national adaptation strategies and plans, it can be assumed that there is a general trend towards increased development of these approaches. This is echoed in the EEA's study on the topic (EEA 2023d). In general, we see that monitoring is most commonly in place, followed by reporting and then evaluation. The latter of these is difficult and time consuming, which may explain the notable lack of efforts within Member States. However, it is worth noting that simply identifying whether MS have adaptation policies and MRE approaches does not allow us to gain insight on the quality or robustness of their approaches, which would require a more detailed assessment.

### Indicators:

- National adaptation policy in place
- Monitoring, reporting, evaluation in place or being developed

**Policy context:** Adaptation governance at the EU level is formalized through the EU Adaptation Strategy. At the MS level, adaptation policy is operationalised through national adaptation strategies or plans (NAS/NAP), which have existed in all 27 MS since 2020. However, while all countries report having such policies in place, these do not all have the same scope, content, or structure (EEA, 2023d). In some countries (15), NAS/NAP documents have already been through at least one revision cycle since their initial adoption. The EEA is currently carrying out a more in-depth review of MS' adaptation policy instruments, to understand their frameworks and legal obligations, monitoring and reporting mechanisms, and updating cycles. The requirements of the Governance Regulation also lay out certain stipulations with regards to national adaptation reporting.

**Areas of action:** As discussed, comprehensive implementation of MRE frameworks across MS is of utmost importance to insure consistency and effectiveness of adaptation approaches. Similarly, it is important that national adaptation policies are assessed for their ambition and coverage, to ensure that they are working towards the high-level objectives of the EU Adaptation Strategy. Furthermore, cross-sectoral policy coherence is a key opportunity for coordination of adaptation actions (EEA, 2023d). Despite the adaptation mainstreaming occurring in all MS, only seven countries currently report sectoral adaptation policies. Similarly, regional adaptation plans present an opportunity for countries to specifically target adaptation actions in areas where certain climate impacts may be more important, or where certain sectors are significantly more vulnerable and require extra adaptation actions.

## Enabler 3: Financing adaptation

**Past progress:** The situation surrounding adaptation finance is challenging. At the EU level, adaptation finance – as a distinct measure from climate finance (covering both adaptation and mitigation) – remains a relatively new topic. As such, gaining a clear picture on the state of adaptation finance remained especially difficult. At the national level, the situation varied significantly. Few countries detailed either required budgets for adaptation or actual spending on adaptation in their national adaptation policies. Even fewer demonstrated comprehensive tracking of planned adaptation expenditure (Ramboll et al., 2023). Furthermore, the methodologies employed, and scope of such budgets differed significantly. Consideration of other aspects of adaptation planning (such as ancillary or co-benefits) was virtually non-existent with regards to budgeting and finances.

### Indicators:

- Total investment needs
- Total planned expenditure
- Actual spending

**Policy context:** Despite recognition of the challenges associated with incorporating climate risks and investment in national budgets, the EU Adaptation Strategy includes an action related to ‘integrating climate resilience in national fiscal frameworks’ under the umbrella of ‘more systemic adaptation’. The strategy notes that extreme weather events and slower-onset climate effects will lead to increased government spending and potentially negative impacts on economic growth. These need to ‘be reflected in budgetary planning’, with significant emphasis placed on the need for sound risk assessments, scenario analyses, and stress-tests. Effective disaster risk management is also highlighted as a key element. The strategy also points to ‘dedicated funds and instruments, both at EU and national level, such as from the EU Solidarity Fund’ as integral to contributing to disaster recovery efforts. Climate adaptation and resilience are furthermore identified as important elements of the EU’s pandemic recovery efforts, especially via the Recovery and Resilience Facility. Related national plans are required to allocate at least 37% of their budgets to climate action covering both mitigation and adaptation. The Adaptation Strategy also links to other EU-focused initiatives such as the sustainable finance efforts, including the EU taxonomy on sustainable activities. Finally, the Governance Regulation covers national reporting on adaptation, but no requirements related to budgets or finance.

**Areas of action:** Monitoring and tracking adaptation finance needs to be improved and streamlined. Availability of information and data on adaptation finance (i.e. investment needs, planned expenditure, actual spending) at the MS level is low, and cannot be assessed in a comprehensive manner. Additionally, it would be important and helpful to monitor the integration of climate risk assessments into other investment areas, such as infrastructure, spatial planning, housing, etc. The EC’s guidelines on harmonising adaptation strategies and plans across MS (EC, 2023v) specifically recommend the development of a dedicated adaptation budget in the context of a comprehensive national climate action budget, considering synergies between mitigation and adaptation. It also suggests that investment needs in the action plans identify the share coming from public budgets versus the share under the mobilisation of private finance. Generally, improved adaptation MRE practices will help gain a clearer picture not only of this enabler, but also in the areas of adaptation governance and adaptation actions.



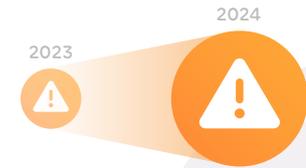
# External Action



**Far too slow**

Addressing climate change requires a collective global approach. It is key for the EU to consider the extraterritorial impacts of its actions, prioritise climate diplomacy and support other nations in decarbonisation efforts.

## 4.13 External Action



**Past progress:** The EU plays a crucial role in leading global climate action, not only because of its ability and responsibility to support partner countries in their decarbonisation efforts but also to maintain its competitiveness in an era increasingly shaped by green competition globally. As in the previous year, development in this building block was **far too slow** over the period assessed. A positive sign is the increase in international climate finance contributions in 2022, which, however, are still too low to meet the EU’s fair share. Imported emissions in the EU remain high. Progress on the enablers was **far too slow** across the board: Alignment of all international finance with the Paris Agreement has hardly seen any progress, as is the case for the integration of climate considerations into other foreign policy areas.

**Policy context:** In some areas, implementation falls short of previously formulated targets, such as in the case of the commitment to halt international public finance for fossil fuels by 2022, which has not yet been achieved. In other areas, effective and ambitious policies have been largely absent for a long time, but are currently being launched, such as the Carbon Border Adjustment Mechanism (CBAM), which can lead to a future reduction in imported emissions. While declarations from EU Foreign Affairs ministers state the intention to align the EU’s foreign policy with climate goals, the reality, e.g., in EU trade agreements or share of Official Development Assistance (ODA) allocated to climate action, still falls short of the intended objective.

**Areas of action:** Progress could be advanced through the enhancement of partnership-building efforts to support other countries in their green transition (ESABCC, 2023), e.g., by expanding investments in clean projects abroad while phasing out support for fossil fuel investments. Additional action is needed to mainstream climate, e.g., by leveraging trade agreements to promote sustainable practices. Additionally, there is a need to empower climate diplomats and institutionalise climate considerations across all policy areas to ensure effective coordination and communication of climate action in the EU and abroad – also in the context of outreach concerning CBAM.

**Table 28: Progress on external action towards the objectives and enablers**

OBJECTIVE	ENABLERS		
Driving ambitious global climate action 	Aligning all international public and private finance with the PA 	Utilising all foreign policy channels to advance the global transition 	Embedding climate considerations in foreign policy 

Note: Large circles show the progress classification of this year and small circles the one from last year’s progress assessment. Arrows indicate positive or negative changes in classification. See Table 35 for further information.

Source: ©ECNO.

Table 29: Details on indicators' past progress and required change

2023 ▼	2024 >	Historical data			Required change	
		Time period	Relative change p.a.	Absolute change p.a.	Benchmark	Absolute change p.a.
<b>OBJECTIVE: Driving ambitious global climate action</b>						
International climate finance [mEUR]		2017–2022 (EUCO, 2024a)	5.7%	1,277 mEUR	n/a	n/a
Imported CO <sub>2</sub> emissions [Gt CO <sub>2</sub> ]		2015–2020 (Eurostat, 2023d)	0.9%	0.01 GtCO <sub>2</sub>	n/a	n/a
<b>ENABLER 1: Aligning all international public and private finance with the PA</b>						
Public finance for international fossil fuel projects (by EIB) [mEUR]		2016–2021 (PFED, 2023)	-5.6%	-6.3 mEUR	EUR 0 by 2020 (EIB, 2019)	-66.33 mEUR per year → 10.5 times faster
Public finance for international clean energy projects (by EIB) [mEUR]		2016–2021 (PFED, 2023)	1.3%	4.5 mEUR	n/a	n/a
<b>ENABLER 2: Utilising all foreign policy channels to advance the global transition</b>						
Paris Agreement references in trade agreements [%]		2016–2018 (IDOS & Université Laval, 2018)	85%	11.5 %-points	100% of all modern agreements (EC, 2022c)	16.8 %-points per year → 1.5 times faster
ODA allocated to climate action [%]		2016–2021 (Donor Tracker, 2023)	-1.5%	-0.4 %-points	n/a	n/a
<b>ENABLER 3: Embedding climate considerations in foreign policy</b>						
Climate-relevant expertise [No. of qualified staff]		n/a	n/a	n/a	n/a	n/a
Prioritisation of climate diplomacy [% of EU GHG emissions covered by 'GoF for Ambitious EU Climate Diplomacy]		2022; 2023 (Udenrigsministeriet, 2023)	n/a	n/a	n/a	n/a

Note: Icons indicate progress classification of this year's progress assessment and coloured lines the change in classification; See Table 35 for further information. n/a indicates that data are not available.

Source: ©ECNO.

## Objective: Driving ambitious global climate action

**Past progress:** Progress towards the objective remained mixed through 2022. The EU and its Member States still failed to fully leverage their potential to play an ambitious and catalytic role in global climate action, particularly in terms of mobilising international climate finance and curbing imported emissions. In 2022, the EU and its Member States notably increased contributions to international climate finance, surpassing EUR 28 billion, which marks the most significant annual increase since 2014. The bloc continued to lead in international public climate finance, having doubled its contributions since 2013 (EUCO, 2024a). Despite this positive trend, progress remained **too slow** in meeting the EU's fair share. The EU's imported emissions trajectory did not improve; on the contrary, emissions generated abroad but consumed domestically remained high (Eurostat, 2023d). Although there was a slight decrease in these emissions in 2020 compared to 2019, likely due to COVID-19's impact on global trade (Y. Liu et al., 2023), these emissions still accounted for about one-third of the bloc's total emissions related to domestic consumption.

### Indicators:

- International climate finance
- Imported CO<sub>2</sub> emissions

**Policy context:** Developed countries have pledged to provide and mobilise USD 100 billion annually in international climate finance from 2020 to 2025. While they failed to reach this goal in 2020 and 2021, it seems probable that it has been met in 2022 (Climate Home News, 2023). The EU and its Member States, as the largest providers of climate finance, have made an important contribution to achieve this long overdue goal. However, the Climate Action Tracker (CAT) rates the EU's international public finance contributions as insufficient and falling short of what is considered a fair share (CAT, 2024). This mirrors advice from the EU Advisory Board, emphasising the EU's responsibility for providing finance for climate mitigation projects outside the EU (ESABCC, 2023). Although imported emissions contribute significantly to the EU's carbon footprint, there are currently no specific legislative measures in place. The forthcoming implementation of the Carbon Border Adjustment Mechanism (CBAM), scheduled to be fully operational by 2026, presents an opportunity to curb imported emissions.

**Areas of action:** Contributions to international climate finance from the EU and its Member need to increase further to align with its fair share and encourage other donors to do the same (IPCC, 2022b). This includes ensuring the New Collective Quantified Goal (NCQG), intended to be set by the end of 2024, is responsive to the needs of developing countries. The EU and certain Member States' proactive involvement in supporting Just Energy Transition Partnerships (JETPs) signifies an encouraging step towards fostering collaboration between emerging economies and international partners. Yet, the present JETP framework may need restructuring to improve transparency, equity, and effectiveness before contemplating expansion beyond current partnerships. Legislation and attention are needed to curb imported emissions, which can be achieved through measures like promoting sustainable trade practices and setting stringent environmental standards for imports.

## Enabler 1: Aligning all international public and private finance with the Paris Agreement

**Past progress:** Progress on aligning all international finance with the Paris Agreement remained **far too slow** over the period assessed. Considering data gaps on overall climate-related international public finance, an assessment of the alignment of financing activities by the European Investment Bank (EIB) is used as a proxy indicator. Although the EIB has shown a positive trend in investing in clean projects outside the EU, investments in such projects dropped by nearly half from 2019 to 2021. At the same time, the bank still invested in parallel around EUR 66 million in fossil fuel projects outside the EU in 2021. The EIB has consequently missed its target to bring all its financing activities in line with the Paris Agreement by 2020.

### Indicators:

- Public finance for international fossil fuel projects
- Public finance for international clean energy projects

**Policy context:** While committing to the Glasgow Climate Pact at COP26, which contains the pledge to halt international public fossil finance for coal, oil, and gas by 2022, the EU and its Member States have yet to demonstrate tangible advancement in the implementation of specific policies. The EU's sustainable finance taxonomy considers gas as a sustainable investment, and the EIB has yet to fully align its financing activities with Paris Agreement goals (Messetchkova, 2021). Furthermore, the proposal to transform the EIB into a 'climate bank' and establish frameworks for aligning financed projects with the Paris Agreement, such as the Path Framework, faces challenges, with the EIB temporarily suspending its Path Framework for renewable energy projects and electric vehicle infrastructure until 2027 due to the energy crisis (EIB, 2019). This suspension potentially enables energy companies, which are major contributors to GHG emissions, to access funding without presenting credible plans to reduce emissions in the medium to long term (Fossil Free EIB, 2022).

**Areas of action:** With the historic pledge made at COP26, the EU and its Member States play a crucial role in fulfilling this commitment to ensure effective use of limited public resources and that its investments support and not undermine global efforts to combat climate change. To uphold a firm dedication to financing clean projects abroad, the EIB could prioritise the continual expansion of investments in such initiatives and reassess its exemption from the Path Framework. Further efforts are needed for the EU to align all public funding with the goals of the Paris Agreement. This includes implementing a budget classification system to monitor the compatibility of external finance, transforming the EIB into a true 'climate bank', and ensuring that financed projects support renewable energy, energy efficiency, and climate resilience measures while phasing out fossil-fuel financing as quickly as possible. Finally, it should be ensured that the EU's current contingency measures and diversification strategy do not hinder global long-term decarbonisation goals or send mixed signals.

## Enabler 2: Utilising all foreign policy channels to advance the global transition

**Past progress:** The EU's progress in leveraging foreign policy for a transition towards a climate-resilient, low-carbon global economy was found to still be **far too slow**. Assessing the success of the EU's aim to use trade policy to support the Green Deal is difficult due to the limited data. A proxy indicator that measures the number of 'references to the Paris Agreement in trade agreements' was used instead, recognising the limitations of this indicator, which provides only a narrow perspective on trade by excluding unilateral measures and enforcement aspects of the agreements. However, it must be noted that in the three years after the Paris Agreement, only one third of trade agreements even referred to the agreement, not to mention making concrete commitments. The allocation of ODA to climate initiatives, another important foreign policy channel, shows a negative trend from 2016 to 2021, despite a recent uptick in 2021, reaching 27%.

### Indicators:

- Paris Agreement references in trade agreements
- ODA allocated to climate action

**Policy context:** The EU emphasises the need of integrating climate considerations into foreign policy, as outlined in the Green Deal and reiterated by EU Foreign Ministers (EC, 2019). Trade agreements increasingly prioritise climate objectives, representing a paradigm shift for trade and climate, away from 'non-impediment' and towards 'positive contribution' (Weyand, 2021). The EU also aims to promote sustainable practices through bilateral and plurilateral trade agreements (EC, 2022n) and collaborates on climate initiatives such as the Coalition of Trade Ministers (EC, 2023aq). Unilateral regulations with extraterritorial impact, such as deforestation-free supply chain regulations or the Corporate Sustainability Due Diligence Directive (CSDDD) and the Carbon Border Adjustment Mechanism (CBAM), that will effectively enter into force in 2026, aim to promote sustainability and address carbon leakage (EC, 2021k).

**Areas of action:** Further efforts are needed to integrate climate considerations into various foreign policy channels, including finance, investment, trade, development cooperation, and industrial policy. Utilising international fora and bilateral/multilateral channels, the EU can actively advocate for decarbonisation efforts, emphasising cooperation rather than punitive measures. Specifically, leveraging its negotiating power in trade agreements to ensure alignment with global environmental and climate goals, the EU can promote sustainable practices worldwide while avoiding patronising approaches, particularly towards the Global South. The EU's trade strategy shows alignment with the European Green Deal but can be improved by addressing implementation challenges and policy coherence (Blot & Kettunen, 2021). By consistently increasing the proportion of ODA allocated to climate action, the EU and its Member States would also provide predictability and signal commitment to partner countries, especially amidst global crises like climate change and geopolitical tensions.

## Enabler 3: Embedding climate considerations in foreign policy

**Past progress:** Compared to the 2023 assessment, there has been no considerable improvement in the EU's attempts to embed climate considerations in all foreign policy areas and to strengthen climate diplomacy. Several EU institutions responsible for climate-related matters face substantial deficits in terms of resources and expertise, highlighting that progress has been **far too slow**. Compared to the previous year, there was a slight increase in the number of Member States joining the 'Group of Friends (GoF) for Ambitious EU Climate Diplomacy', with membership rising from 11 to 12 (Udenrigsministeriet, 2023). This signifies a prioritisation of climate diplomacy within the foreign policies of these nations. However, the growth of the group can be assessed as **too slow** given the size of the task at hand and the time pressure to combat climate change.

### Indicators:

- Climate-relevant expertise
- Prioritisation of climate diplomacy

**Policy context:** The EU has expanded the scope of climate diplomacy beyond the UNFCCC negotiations (Tänzler et al., 2021). It has recognised the connections between climate policy and key foreign policy domains such as international trade, investment, and development cooperation (EUCO, 2018). However, there are notable capacity gaps within various EU institutions responsible for foreign climate policy, including resource deficiencies and a lack of expertise (Kahlen et al., 2023). For instance, DG TRADE exhibits limited familiarity with climate-related matters, often outsourcing environmental impact assessments for Free Trade Agreements (FTAs) to third-party organisations outside the EU (Velasco & Peters, 2022). The EU has taken steps to enhance coordination and cooperation in climate diplomacy. This includes the establishment of a team of climate diplomats within the European External Action Service (EEAS) led by an Ambassador at Large for Climate Diplomacy (Tollman & Pilsner, 2021). The EEAS is tasked with coordinating Member States' climate ambassadors to facilitate joint climate diplomacy activities and strategies. Additional ad-hoc groups, such as the Climate Ambassador Network and the Green Diplomacy Network, have been formed to promote coordination and information sharing among Member States. However, resources for climate diplomacy within the EEAS and EU Delegations remain inadequate (Biedenkopf & Petri, 2021).

**Areas of action:** To mainstream climate considerations into EU foreign policy effectively, it will be key for the EU to enhance climate competences and expertise within its key foreign policy institutions as well as empowering the EU Climate Ambassador at Large for Climate Diplomacy and expanding its team. The EEAS and EU delegations could take the lead in actively informing about CBAM's impact and encouraging global compliance with the regulations. Additionally, establishing structures to institutionalise climate considerations across all foreign policy areas is crucial for effective coordination. Recognising that climate change is no longer a niche topic, adequate capacities, including budgetary allocations and staffing, should be developed within various EU institutions, particularly those engaged in external relations.

# 5 A closer look at progress in four enablers towards a climate neutral future

To expand the understanding of progress at EU level, this year's flagship report includes a more in-depth analysis of four strategically chosen enablers to better understand the dynamics determining EU level trends.

**Table 30: Selected enablers for this year's deep dives**

ENABLER DEEP DIVE	BUILDING BLOCK	INDICATORS
<u>Implement zero emission transport</u>	 Mobility	<ul style="list-style-type: none"> <li>• Share of EVs in passenger car stock</li> <li>• Share of ZLEV in heavy-duty vehicle stock</li> <li>• Share of ZLEVs in new passenger car registrations</li> <li>• Total number of recharging points</li> </ul>
<u>Store more carbon in trees</u>	 Carbon Dioxide Removal	<ul style="list-style-type: none"> <li>• Growth in forest area</li> <li>• Growth of carbon stock in forest land</li> </ul>
<u>Channelling public funds away from fossil fuels</u>	 Finance	<ul style="list-style-type: none"> <li>• Public climate subsidies</li> <li>• Fossil fuel subsidies</li> </ul>
<u>Job opportunities</u>	 Just and Inclusive Transition	<ul style="list-style-type: none"> <li>• Employment rate in regions</li> <li>• Employment in all Renewable Energy Sources</li> <li>• Employment in Environmental Goods and Services</li> </ul>

Source: Own representation

## 5.1 Implementing zero emission transport

Progress towards implementing zero emission transport is improving, but needs to be further accelerated

**Past progress:** Progress towards implementing zero-emission transport improved in recent years: the share of zero emission vehicles (ZEVs) in the light- and heavy-duty vehicle stocks increased by nearly 60% and 140%, respectively, between 2017 and 2022, while the total number of recharging stations in the EU increased by over 190% per year between 2018 and 2023. Even though there has been real growth in zero and low emission vehicle and infrastructure deployment, the overall pace of progress was still

**far too slow** in the assessed period: to achieve climate neutrality, ZEVs must account for 99% of the total passenger light-duty vehicle (LDV) stock and 70% of the total heavy-duty vehicle (HDV) stock in 2050 (EC, 2020g). To do so, the annual increase in ZEV uptake needs to occur 8 times faster for passenger vehicles and 444 times faster for heavy-duty vehicles. While 21.6% of new passenger car registrations were ZEVs in 2022, up by nearly 20% compared to 2018, the share is still increasing **too slowly** to reach the EU's 100% zero emission new passenger vehicles sales target by 2035. The EU's recharging network is expanding but is being developed **too slowly** to be compatible with climate neutrality; the rate of progress for recharging points must increase by 3.8 times.

**Policy context:** The EU strengthened the CO<sub>2</sub> emission performance standards in 2023 and, in doing so, effectively initiated the phase-out of ICE-based passenger vehicles by 2035. However, following Member State (MS) resistance, the standards may be amended to allow for carbon-neutral fuelled ICE vehicles after 2035. The EU reinforced the Alternative Fuels Infrastructure Regulation (AFIR) in 2023 to better coordinate recharging infrastructure development. MS have developed a diverse range of purchase subsidies, tax benefits, and behavioural incentives to support ZEV uptake and recharging infrastructure deployment. Even so, ZEV uptake is limited by upfront costs and insufficient recharging infrastructure, resulting in uneven progress across MS.

**Areas of action:** Progress could be made by strictly enforcing CO<sub>2</sub> emission standards for LDVs and formally adopting the proposal for more stringent standards for HDVs (EC, 2023ae). To improve affordability and access to ZEVs, Member States could expand fiscal policies that render ZEVs more cost competitive. The EU could encourage good fiscal policy practices to ensure equitable access to ZEVs across borders. Additional policy to support the accelerated development and deployment of heavy-duty ZEVs is necessary. Both EU- and MS-level policies could incentivise the production of more efficient, compact, and affordable ZEVs. Expediting stock turnover for ICEs and establishing the used ZEV market could be supported by national and EU-level policy.

**Table 31: Progress towards implementing zero emission transport**

Share of EVs in passenger car stock [%]	
Share of ZEV in heavy-duty vehicle stock [%]	
Share of ZEVs in new passenger car registrations [%]	
Total number of recharging points [#]	

## A closer look at past progress

Achieving climate neutrality in the transport sector requires a fundamental shift away from ICE vehicles towards zero and low emission vehicles—particularly battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs)—across both the light- and heavy-duty vehicle segments. The share of ZEVs in the existing stock contextualises the current state of decarbonisation in road transport, while the share of new ZEV registrations provides insight into the future makeup of the total vehicle stock. To support the diffusion of ZEVs, a robust and accessible recharging network across rural and urban settings is required.

### Share of ZEVs in new passenger car registrations [%]

Globally, Europe is a frontrunner in light-duty ZEV deployment; the continent accounts for 25% of global electric car sales and 30% of the global stock of EVs (IEA, 2023a). In 2022, 21.6% of new passenger vehicle registrations were ZEVs (EEA, 2023f). This share was increasing by 4.5%-points per year for the assessed period. However, this rate is still **too slow** to reach the 100% sales target in 2035 (assuming linear growth). New ZEV registrations must increase by at least 6%-points per year to achieve the 2035 target.

The European ZEV market is increasingly competitive (IEA, 2023a). New players, especially from China (ACEA, 2023c), are disrupting the European market with more affordable options and are putting pressure on legacy auto manufacturers to expand their electric offerings and reduce retail prices (Carey et al., 2024). Nevertheless, affordability remains a principal barrier to ZEV adoption (ACEA, 2023e). Currently, purchase prices for BEVs in the EU are still substantially higher than for ICE counterparts: in 2021, the average cost of a new BEV was just under EUR 50,000, while the average ICE retailed at EUR 30,000 (IEA, 2022b). What contributes to the higher purchase price is that a disproportionate share of new BEVs belongs to the high-price, premium vehicle segment (T&E, 2024a). The unaffordability of BEVs raises equity concerns: there exist vast differences in the share of ZEVs in Northwestern Member States in comparison to Central, Eastern, and Southern countries that link to differences in average incomes between countries (ACEA, 2023d). Although typically more expensive upfront, the reduced running costs of BEVs mean that the total cost of ownership for BEVs is at least equal to or cheaper than traditional ICE vehicles (Ellerbeck, 2023); the higher purchasing price can be fully recovered in as little as five years of ownership (Liu et al., 2021).

At the MS level, countries that reduced the purchase price of electric vehicles and offer other incentives had the highest registration shares of ZEVs (IEA, 2018). Additionally, both the EU and Member States are expanding recharging infrastructure and, in doing so, are removing a significant barrier to ZEV adoption. Across all Member States, the share of ZEVs in new passenger car registrations has grown substantially: between 2017 and 2022, registrations increased by nearly 67% per year. Spearheading the growth in new passenger ZEV registrations are Sweden and Finland, where over half of all new passenger vehicle registrations were ZEVs in 2022; the shares of ZEVs in new registrations are 59.5% and 54.6%, respectively. In Denmark, the Netherlands, and Belgium, new ZEV registrations account for over 40% of all 2023 LDV registrations (EAFO, 2024b). The variety in policy structure (see below), combined with the wide range of socioeconomic conditions and cultural preferences across the EU, results in diverse progress in ZEV uptake between Member States.

**Figure 4: Past progress by Member States in increasing the share of ZEVs in new passenger vehicle registrations**

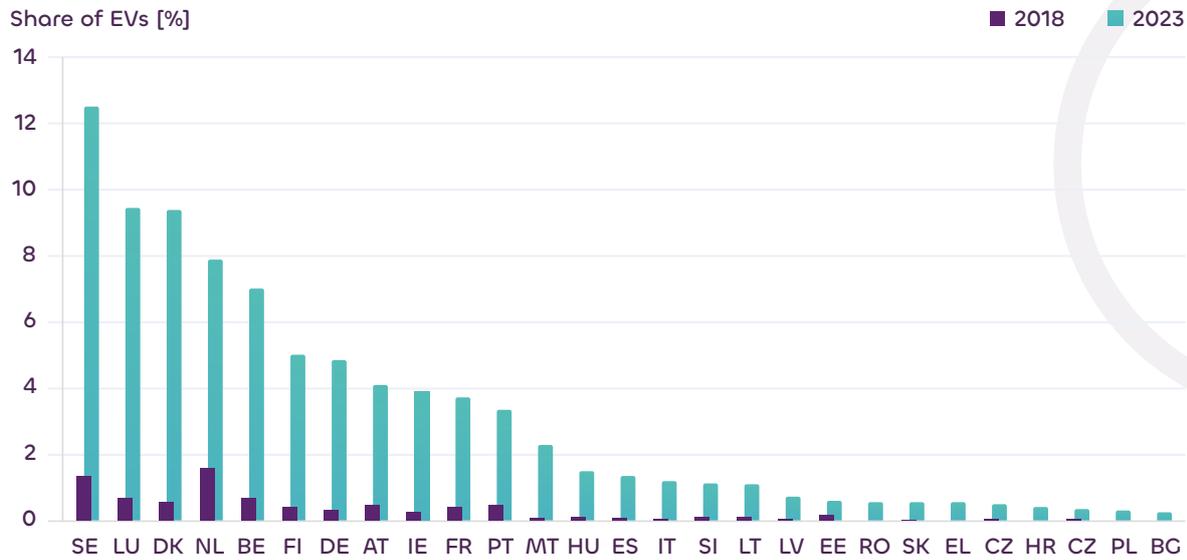


Source: EAFO (2024a). Note: ZEVs include EVs (including battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and plug-in hybrid vehicles (PHEVs)) as well as hydrogen combustion engine vehicles (H2-ICEVs).

### Share of EVs in passenger car stock [%]

By 2050, ZEVs must make up 99% of the total share of passenger cars (EC, 2020g). In 2022, the share of EVs in the total passenger car stock amounted to only 2.3% and was increasing **far too slowly**. Between 2017 and 2022, the share of EVs increased by 0.4%-points annually. To reach a 99% share of ZEVs by 2050, the yearly increase in the share of EVs must happen at least 8 times faster. It is worth noting that this assessment assumes linear growth in EV deployment. However, EV deployment may increase exponentially and follow an S-curve pattern. Signs of exponential growth are already visible: despite only accounting for less than 3% of the total LDV stock in 2022, the EU’s ZEV fleet size increased more than 10-fold in only five years (EAFO, 2024b). Several Member States dominate the overall EU trend. Sweden is the Union’s clear frontrunner: ZEVs made up 12.6% of the total stock of passenger cars in 2023. To put the growth of the Swedish ZEV share in perspective, ZEVs only comprised 1.4% of the passenger car stock in 2018. The share of ZEVs in Luxembourg and Denmark accounted for approximately 9.4% of their respective car stocks in 2023, while the share of ZEVs hovered around 7.9% in the Netherlands. With about 2.4 million ZEVs in 2023, Germany boasts the greatest total number of ZEVs in the EU (EAFO, 2024b). The share of ZEVs in the overall vehicle stock is directly linked to the new registrations in the Member States. Therefore, the same tools that drive ZEV registrations—robust financial incentives and extensive recharging infrastructure—increase the share of ZEVs in the total passenger vehicle stock.

**Figure 5: Past progress by Member States in increasing the share of EVs in passenger car stock**

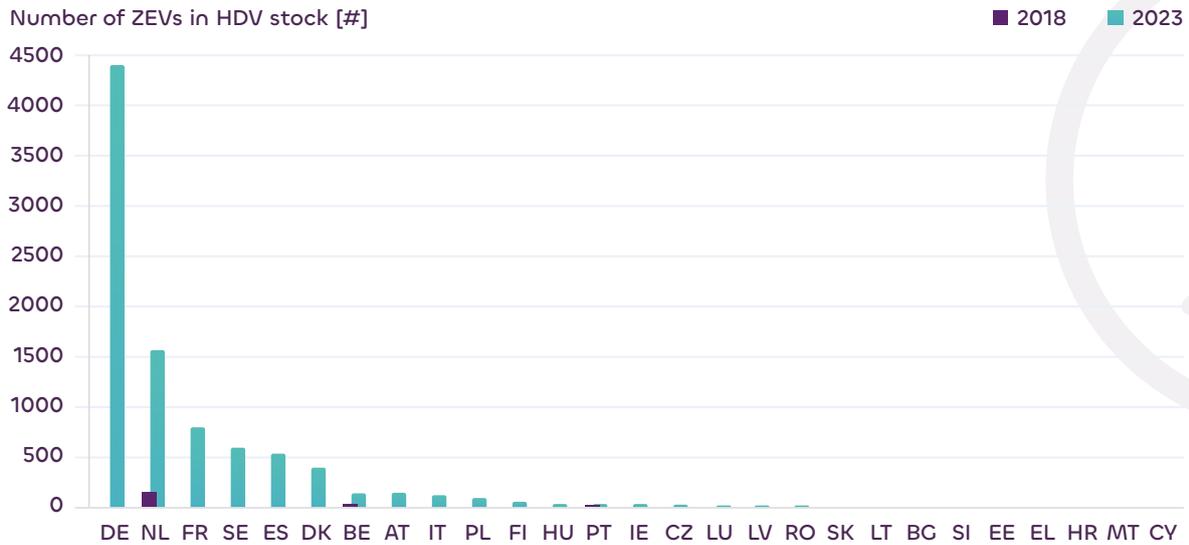


Source: EAFO (2024a).

### Share of ZEVs in heavy-duty vehicle stock [%]

To align with the EU’s climate neutrality target, the share of ZEVs in the heavy-duty vehicle stock needs to reach 70% by 2050 (EC, 2020g). It is important to note that the zero and low emission HDV segment is in a much earlier stage of development compared to the LDV sector: battery electric HDVs have only recently become commercially available (Lowell & Culkin, 2021), while hydrogen fuel cell HDVs are still in the early development phase (Collins, 2021). As a result, ZEVs only made up a total of 0.03% of the HDV stock in 2022, even though the share of ZEVs in the HDV stock increased by nearly 140% between 2017 and 2022 (IEA, 2023a). To reach a 70% share by 2050, the annual increase in ZEV uptake needs to occur 444 times faster (assuming a linear trajectory). To achieve the desired share by 2050, the EU and Member States could more proactively further research and development for zero and low emission HDVs and remove barriers to adoption. Germany is the clear frontrunner for deploying heavy-duty ZEVs. In 2023, over 4,400 heavy-duty ZEVs were registered in Germany. In comparison, only 11 such vehicles registered in the country in 2018. Driving this uptake were some of the largest financial incentives for operating commercial ZEVs in the EU (ACEA, 2023b).

**Figure 6: Past progress by Member States in increasing the total number of ZEVs in heavy-duty vehicle stock**

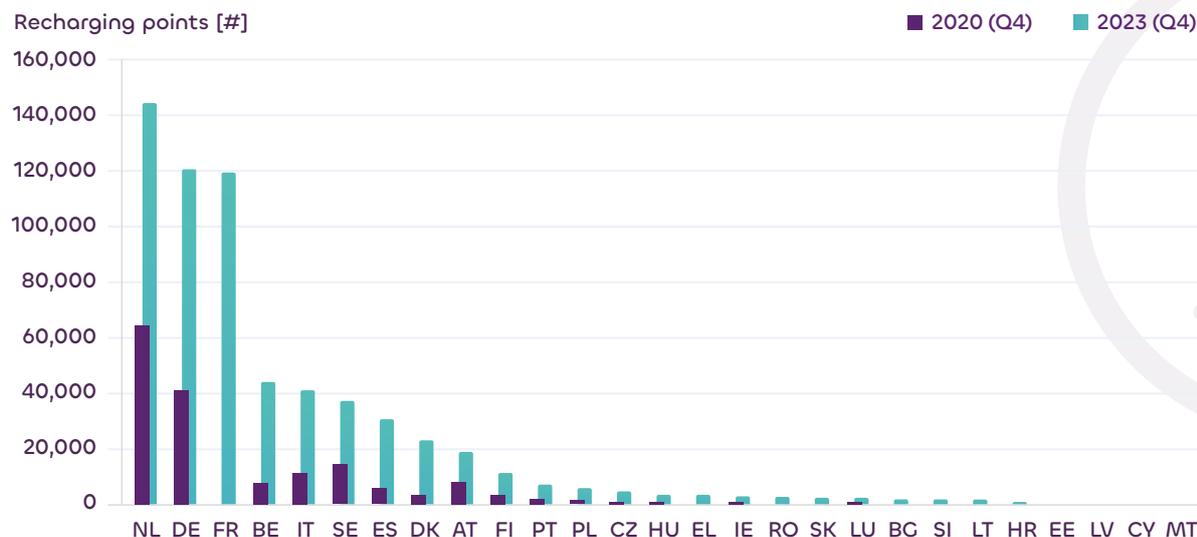


Source: EAFO (2024a).

### Total number of recharging points [#]

The total number of recharging points in the EU increased by over 190% between 2018 and 2023. Nevertheless, the EU's recharging network is being built out **far too slowly**. Based on the EC's impact assessment for the revised AFIR, the EU needs 16,268,705 publicly accessible recharging points by 2050 to be compatible with the EU's climate neutrality target. In 2023, the EU only had 632,390 operational recharging stations. To reach the target number, the rate of progress needs to increase by 3.8 times relative to the current rate. So far, recharging infrastructure development has been disparate across Member States: in 2023, over 50% of all recharging points in the EU were located in the Netherlands, Germany, and France (Melissa, 2024). Overall, the Netherlands leads the EU in recharging point deployment. In the Netherlands, there are nearly 300 recharging points for every 100,000 residents, in comparison to an average of 92 points in the rest of Europe (GridX, 2023). In 2023, the country had over 140,000 operational recharging points (EAFO, 2024b). Already in 2022, Dutch recharging points accounted for 29.4% of all recharging points in the EU (ACEA, 2022). The robust expansion of the Dutch recharging network is the result of a clear national agenda and ambitious subnational action aimed at expanding access to recharging points (see below).

**Figure 7: Past progress by Member States in increasing the the total number of recharging points**



Source: EAFO (2024a); Note that no data was available for France in 2020.

## EU and Member States policies

In the transport sector, EU- and MS-level policies reinforce each other. At the EU level, more stringent CO<sub>2</sub> emission standards are applying supply-side pressure on auto manufacturers to increase the number of ZEV offerings in their fleet. At the MS level, purchasing subsidies for ZEVs and fuel taxes on ICE vehicles are activating a demand-side response. Both EU- and MS-level initiatives are funding the development of recharging infrastructure and expanding coverage across borders and across urban, suburban, and rural settings. Policies at the subnational level, such as behavioural incentives, can further facilitate ZEV uptake (Wappelhorst et al., 2020).

### EU policies

The EU's main policy lever for facilitating the uptake of ZEVs is its CO<sub>2</sub> emission performance standards for new vehicles. Emission standards play a central role in increasing ZEV sales worldwide (IEA, 2021a). In 2023, the EU strengthened the CO<sub>2</sub> emission performance standards for new light-duty cars and vans. The updated 2030 emission reduction target is now 55% for new passenger cars and 50% for vans compared to 2021 levels. For 2035, the emission reduction target is 100% for both cars and vans. While technically initiating the phase-out of ICE vehicles, there is some flexibility built into the legislation. A coalition of Member States successfully lobbied for the drafting of an amendment to the standards that would allow for the continued use of ICE vehicles that run on CO<sub>2</sub>-neutral fuels after 2035 (Sims & Abnett, 2023; Wacket & Abnett, 2023). To qualify as a CO<sub>2</sub>-neutral fuel or e-fuel, as defined in the RED III Directive, the fuel only needs to reduce its GHG emissions by 70% compared to traditional fossil fuels. This means that vehicles running on CO<sub>2</sub>-neutral fuels are not zero emission and, instead, are estimated to emit 61 gCO<sub>2e</sub>/km in 2035 (T&E, 2023a). The CO<sub>2</sub> emission standards also introduced a regulatory incentive mechanism that rewards auto manufacturers with less stringent CO<sub>2</sub> reduction targets if the manufacturers reach a 25% share of zero and low emission passenger vehicle sales.

Allowing low emission vehicles, and not only zero emission vehicles, to count towards reducing manufacturers' fleet-wide CO<sub>2</sub> targets, prolongs the production of CO<sub>2</sub>-emitting, ICE-based plug-in hybrids and hinders a more rapid transition to battery- and hydrogen-based ZEVs. Nevertheless, five of the largest auto manufacturers in Europe, representing a 46% market share, have pledged to sell exclusively BEVs by 2030 (GridX, 2023).

The EU has proposed and nearly adopted updated CO<sub>2</sub> emission standards for HDVs (Eickhout, 2024). Raising ambition for HDV emission reductions is critical for achieving climate neutrality, as commercial vehicles have increasing and disproportionate effects on energy use, air pollution, and CO<sub>2</sub> emissions (IEA, 2021a). The proposed emission standards would mandate emission reductions of 45% in 2030, 65% in 2035, and 90% in 2040. The proposal introduces a separate emission reduction target of 100% for urban buses for 2035. Like the LDV emission standards, heavy-duty vehicles that use CO<sub>2</sub>-neutral fuels will likely count towards the EU's emission reduction targets (Abnett & Wacket, 2024).

To further enable the uptake of ZEVs, the EU revised the Alternative Fuels Infrastructure Regulation (AFIR). The revision establishes distance-based targets for recharging infrastructure to address disparities in the recharging station development across Member States. The AFIR stipulates the construction of fast recharging stations for light-duty vehicles every 60 km along the TEN-T road network. For heavy-duty vehicles traveling on TEN-T routes, the AFIR sets targets for recharging vehicle stations for every 50 to 100 km, and every 200 km for hydrogen refuelling stations.

### Member States policies

To increase the share of ZEVs in their domestic fleets, Member States use financial instruments to reduce vehicle upfront and operational costs. In 2023, all 27 Member States offered some form of tax benefit or purchase incentive for zero emission passenger vehicles (ACEA, 2023a). Tax benefits reduce value added taxes, registration fees, or ownership costs for individuals or companies. Purchase incentive schemes reduce the price gap between ZEVs and ICE equivalents by providing cash bonuses for buying ZEVs (IEA, 2021a). In some cases, purchase incentives also cover costs related to recharging. Some Member States additionally levy high taxes on petrol and diesel to further increase the cost competitiveness of ZEVs. A high tax differential—achieved by levying high taxes on polluting vehicles and low taxes on non-CO<sub>2</sub> emitting vehicles—correlates with higher uptake of zero and low emission passenger vehicles in the EU (T&E, 2022a). To reduce the fiscal burden of ZEV purchase subsidies, France's 'Bonus-Malus' system imposes a strict tax on emission-intensive vehicles and uses the tax revenue to finance bonus payments for electric vehicles (EUKI, 2019). The scope and structure of these fiscal policies, and the resulting tax burdens, differ substantially across Member States (T&E, 2022b). Purchase incentives range from EUR 1,500 in Hungary to upwards of EUR 12,000 in Cyprus (ACEA, 2023a). The level of registration and ownership tax deductions can be based on the level of CO<sub>2</sub> emission reduction, air pollution reduction, fuel type, vehicle weight, engine displacement, or year of production depending on Member State (Danielis, 2023). National fiscal policy is bolstered by subnational behavioural incentives. Urban access restrictions, parking benefits, public recharging points, electric vehicle awareness programs, and congestion charging discounts at the municipal level have been demonstrated to increase ZEV uptake in cities across the EU (Bernard et al., 2021).

Citing the increasing domestic price competitiveness of light-duty ZL (IEA, 2023a), **Sweden** entirely eliminated its state-sponsored acquisition subsidies for electric cars and plug-in hybrids in 2022 (EAFO, 2024b). The Swedish government previously offered strong economic incentives for zero and low emission vehicle adoption: between 2018 and 2022, the government provided up to approximately EUR 6,000 for new electric vehicles, while raising the vehicle tax for traditional ICEs (ITA, 2022; Kotilainen et al., 2019). Sweden, which features the highest share of ZEVs in its existing fleet and in new registrations of passenger vehicles in the EU, still reduces the annual road tax for zero emission cars and provides grants and tax deductions for installing at-home charging equipment (ACEA, 2023a).

In **Germany**, purchase incentives stimulated a tenfold increase in the share of electric vehicles in total LDV sales (IEA, 2023a), until Germany abruptly phased-out its purchase incentive scheme for passenger and commercial ZEVs in 2023 due to federal budgeting complications. Until the end of 2023, Germany provided significant financial incentives for zero and low emission HDVs (IEA, 2023a): 80% of additional vehicle costs and recharging infrastructure were subsidised (BMDV, 2021), and ownership taxes were absolved for a ten-year period (ACEA, 2023b). Germany is now shifting its focus towards increasing its financial support for infrastructure development (BMDV, 2024).

**Poland** is broadening and diversifying its purchase incentives and tax benefits for ZEVs. The Polish LDV market is one of the largest in the EU and is dominated by ICE vehicles (Kadiri, 2024a). However, the Polish government has set ambitious targets for ZEV sales and recharging infrastructure development. Since 2018, the government has been subsidising ZEV purchases and, in 2021, unlocked an additional EUR 115 million. In 2021, the government also implemented a novel subsidy scheme, ‘My e-car’, that reduces monthly lease payments for EVs (KPMG, 2021). The policy’s implementation increased EV sales by 140% and 40,000 new EVs were registered in the first six months following the policy’s adoption (Harper, 2022). In addition, BEVs are entirely exempt from sales taxes and qualify for a purchase subsidy of roughly EUR 4,000 (ACEA, 2023a). In 2023, Poland also began subsidising recharging infrastructure (IEA, 2023a).

**The Netherlands** features one of the densest recharging networks in the world (NAL, 2022) (see below). The government has developed a national strategy for developing ZEV recharging infrastructure: the Dutch National Charging Infrastructure Agenda. The Dutch agenda emphasises the importance of coverage and access, prioritising public, interoperable recharging stations across urban and rural areas (NAL, 2022). National ambition is complemented by progressive subnational policy. Cities are developing zero-emission zones in urban centres and municipal governments in Amsterdam, Rotterdam, and The Hague provide public recharging points for individuals and businesses in cases where private recharging is not possible (Bernard et al., 2021).

**Portugal** ranks seventh in the EU with its share of ZEVs in new light-duty vehicle registrations (EAFO, 2024b). Driving the zero and low emission LDV sales in Portugal is a combination of purchase and tax benefits and a highly accessible recharging network. Individuals receive a premium of EUR 3,000 to purchase a new BEV and are exempt from registration and ownership taxes (ACEA, 2023a). Portugal's recharging network, the Mobi.E Network, is characterised by digitalisation and interoperability (Kadiri, 2024b); over 4,500 public recharging points are operational and can be monitored in real time using a mobile app.

## Areas of actions

The stricter CO<sub>2</sub> emission performance standards—which have been adopted for LDVs but have not been ratified for HDVs—will only have the desired supply-side effect if compliance is closely monitored and if non-compliance is penalised. If penalties are insufficient, legislation should be revised (Hu et al., 2021). Additionally, the potential classification of carbon-neutral-fuelled vehicles as zero-emission under the emission standards warrants careful consideration, as these ICE-based vehicles are not strictly zero-emission. Furthermore, the EU could accelerate progress by following through on its proposal to green corporate fleets; an important area of action, as corporate fleets accounted for nearly 60% of all new vehicle sales in the EU in 2022 (T&E, 2023b).

The EU could identify good practices at the MS level for supporting the uptake of ZEVs. Benefit structure and scale vary significantly between Member States for passenger ZEVs (ACEA, 2023a), resulting in highly varied diffusion rates. The link between EV adoption and GDP per capita in the EU (ACEA, 2021a) should be addressed, as Northwestern Member States with higher incomes have significantly higher EV shares (more than 30%) than those with lower average incomes in Central, Eastern, and Southern Europe (roughly 10%) (ACEA, 2023e). GDP and recharging point deployment are similarly correlated (ACEA, 2021b).

Member States could expand financial mechanisms that disincentivise ICE-based HDVs and incentivise zero-emission alternatives. Given that purchase costs are a key barrier, purchase incentives can be useful for HDVs (Sugihara et al., 2023). However, Member States offer notably fewer incentives for HDVs than for LDVs (ACEA, 2023b). The HDV segment also faces technical and logistical challenges regarding vehicle weight, as well as recharging frequency and duration, that do not apply to LDVs (Panayi, 2019).

EU- and MS-level policy could incentivise the production and uptake of compact, energy- and resource-efficient light-duty BEVs, as energy and resource efficiency are not considered in current legislation (ESABCC, 2024). While BEVs are more energy efficient than ICE vehicles, substantial differences in energy and resource efficiency exist between BEVs based on their size and weight: doubling the mass of a BEV results in a 40% increase in its real-world energy consumption (Weiss et al., 2020) and larger BEVs demand 75% more critical raw materials for their batteries relative to smaller BEVs (Lander & Grazia, 2023). The EU's emission standards do not explicitly prompt efficiency improvements for ZEVs; to the contrary, the standards use the average mass of sold vehicles per manufacturer to determine a manufacturer's progress in emission reduction (EC, 2023b), which may implicitly encourage the production of larger vehicles that are more energy and resource intensive (Thies et al., 2022). By incentivising the production of large BEVs, the

EU is also reducing access to BEVs because larger vehicles tend to be more expensive: in 2023, there was only one BEV for sale in Europe that retailed for under EUR 20,000. To address affordability and equity concerns, the EU could reconsider the design of the CO<sub>2</sub> emission standards and develop industrial policy that incentivises the production of affordable ZEVs (T&E, 2024a).

EU policy could further support the development of secondary ZEV markets. Increasing the sale of new BEVs will increase the supply of older, used BEV models (Morrison & Wappelhorst, 2024). However, BEVs face unique barriers to entry into the secondary market, such as the decline in battery capacity over time, that can be addressed through cost-effective battery swapping policies (IEA, 2023a). Additionally, the early retirement of older vehicles could be supported through ‘cash-for-clunkers’ programmes (Naumov et al., 2022).



## 5.2 Storing more carbon in trees

### Striving for near-natural forests

**Past progress:** Forests are the key land solution for removing CO<sub>2</sub> from the atmosphere. But progress is still moving in the **wrong direction**. The carbon stock in forest land as well as forest area are increasing, but at a decreasing growth rate. France is the primary Member State driving the increase of forest area and carbon stock (reporting a steady growth rate despite recent signs of decreasing net LULUCF removals (EEA, 2023b), followed by Italy and Poland.

**Policy context:** Current EU policies seem insufficient to deliver the required increases in forest carbon stores. The EU has few competencies for forestry policy, which is set mostly at the national level. The EU's LULUCF Regulation mandates net GHG removal targets for natural sinks, with forests as the key component. The proposed Nature Restoration Law sets goals by 2030 to enhance forest ecosystems. The Forestry Strategy (EC, 2021g) lays out a plan to protect existing forests and increase cover. The CAP provides financial incentives. The proposed Forestry Monitoring Law (EC, 2023x) aims to improve the knowledge base. Most Member States have targets to increase forest area, trees planted and improve sustainable forest management. However, targets are often unclear regarding details and implementation plans. The EU (through the CFCR) and some of its Member States (e.g., France) have implemented or are considering voluntary certification schemes for forest carbon removals.

**Areas of action:** To achieve the LULUCF target and enhance other forest ecosystem services, the EU should follow-up on its own guidance to Member States on sustainable forest practices and further promote restoration, reforestation and sustainable management (including a shift towards more near-natural forests, to additionally support other ecosystem services such as biodiversity conservation). It is also crucial that certified removals are of high integrity. The CAP's impact on sustainable forest practices could be improved through capacity building to help landowners implement CAP measures, while applying robust monitoring techniques to ensure that the measures have been implemented.

**Table 32: Progress towards storing more carbon in trees**

Growth in forest area [ha per year]	
Growth of carbon stock in forest land [MtC per year]	

## A closer look at past progress

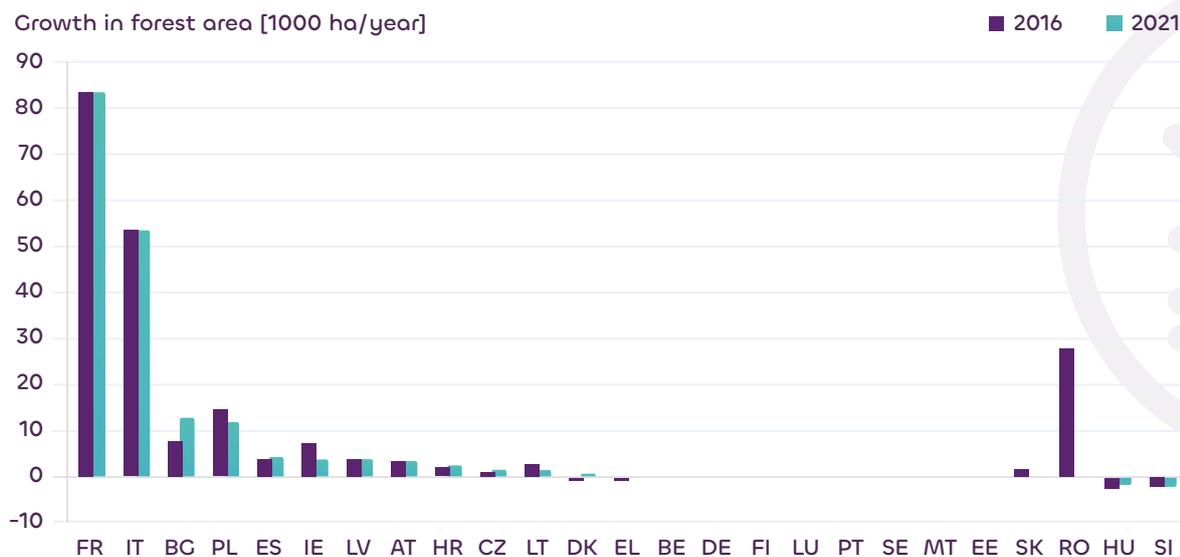
The EU's forests represent major terrestrial carbon sinks and are the key land solution for removing CO<sub>2</sub> from the atmosphere, currently removing around 10% of GHG emissions from other sectors (EEA, 2023b). In addition, they provide other valuable ecosystem services including air purification, flood protection, biodiversity, and recreation. However, progress in forest CDR is still moving in the **wrong direction** and the five-year trendline of net natural removals is still decreasing, following a declining rate of carbon stored in trees due to increased harvesting, tree mortality (worsened by climate change) and mismanagement (ESABCC, 2024a; Hyyrynen et al., 2023). To reverse the trend, forest area and/or forest density must increase at a larger scale while also protecting ecosystems and ensuring their resilience. The volume of carbon removal benefits from restoration and improved forest management is shown in the rate of biomass growth (Bernal et al., 2018). Monitoring the growth of carbon stock in forest land is moreover a useful indicator of forest size, and density of tree planting.

It must be noted that steady CO<sub>2</sub> removal by forests requires steady growth in forest biomass. This means that the growth rate of forest area and/or of the carbon stock must increase compared to the former year to lead to an increased CO<sub>2</sub> removal. In other words, it is not enough if forest area and/or the carbon stock is growing but it must grow faster for CO<sub>2</sub> removals to increase.

### Growth in forest area [ha per year]

The geographical coverage of forest land in the EU increased by 5% between 2000 and 2021, reaching 159 million hectares (Mha). Meeting the 3 billion tree pledge by 2030 is expected to require around 1 Mha additional forest land (Lee et al., 2023) – based on current trends, the EU is **on track** towards meeting this target.

However, even though forest area has increased in recent years, it has done so with a declining rate – from a growth of 212,000 hectares (ha) in 2016 to only 182,000 ha in 2021. This decrease in area growth means that less additional land was available to store CO<sub>2</sub> in that year, leading to a reduction in natural removals. Figure 10 compares the growth of forest area in various MS between the years 2016 and 2021. France reported the highest growth of 83,000 ha of forest land per year in both 2016 and 2021. Italy reported the second highest growth of 54,000 ha in both years. Negative growth rates were reported in Hungary and Slovenia for both years, meaning that forest area even decreased in these countries during this period. Data was available for 25 out of 27 MS, with six MS having had no changes in forest area in neither 2016 or 2021, and ten MS having had equal changes in forest area in the years 2016 and 2021. This points to a lack of unique datapoints within the dataset, which in turn evidences insufficient monitoring across the EU.

**Figure 8: Past progress of Member States towards growing the area of forest cover**

Source: FAO (2024). Note: Annual growth in forest area for years 2016 and 2021, for all EU Member States apart from Netherlands and Cyprus where no data was reported.

The feasibility of increased tree planting largely depends on land availability. Competition for land strongly influences land availability and the financial viability of forests in relation to other competing uses like agricultural production. This is affected by demand (and consequently prices) for wood, food, housing, infrastructure, industry, as well as broader economic conditions. The financial viability of forests can also depend on government support and the incentives provided for afforestation, reforestation and improved forest management (e.g., subsidies, carbon credit revenues). Increased monitoring requirements can reduce incentives (Cacho et al., 2004), but improved accuracy and knowledge of carbon fluxes enables more targeted interventions (e.g., incentives for the protection of old-growth forests). In recent decades, EU forest area has increased while the area of agricultural land has decreased (FAO, 2024).

Several EU policies are putting upwards pressure on the demand for agricultural land relative to forest land, including the CAP with its incentives for livestock and feedstock production (ESABCC, 2024a). The EC's commitment, under the Farm to Fork Strategy (EC, 2020c), to increase organic farming and reduce fertiliser use by 20% each risks putting further pressure on the demand for land to sustain food production, despite its positive environmental impacts. Reducing food waste, but also reducing livestock emissions coupled with an increasingly plant-based diet would partially alleviate this dilemma, lowering the costs of further forest expansion (ESABCC, 2024a) ([see also 4.5](#)).

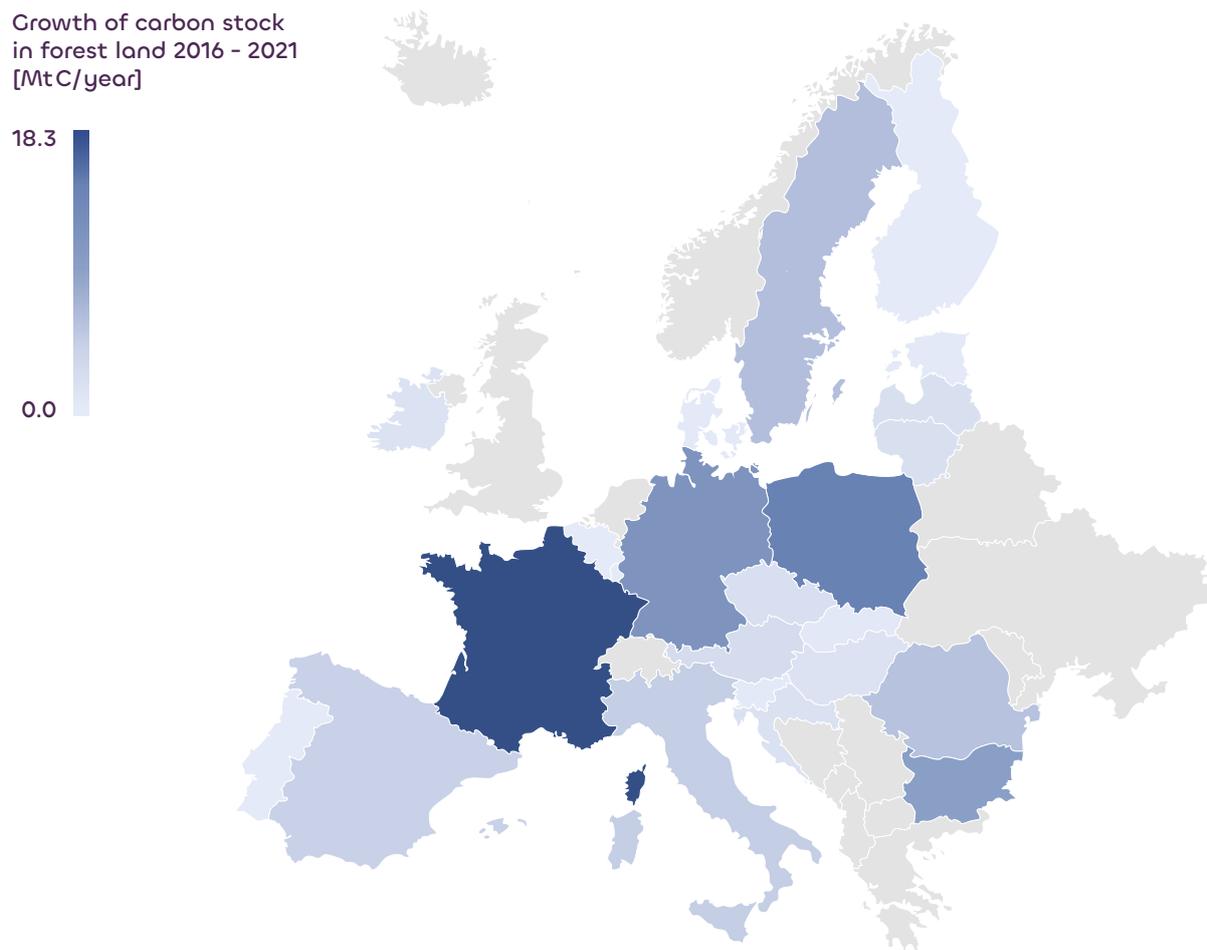
### Growth of carbon stock in forest land [Mt C per year]

The carbon stock in forest land is increasing, but at a decreasing rate, from a 119 Mt C increase in 2016 to a 73 Mt C increase in 2021. The increase in the growing stock of carbon in forests was greater than the expansion of forest area over the same period, which means that on average the carbon stock density of forests has increased in the EU. Still, the decreasing trend in carbon stock growth means that less additional CO<sub>2</sub> is stored in

each year leading to an overall reduction in natural forest removals. [Figure 2](#) compares the growth of carbon stock in forest land in various EU Member States averaged between 2016 and 2021. France reported the fastest growth rate of 18 Mt C per year. The next most significant driving countries of the carbon stock in EU forests are Poland (13 Mt C/year), Germany (11 Mt C/year), and Bulgaria (10 Mt C/year).

The declining growth rate of carbon storage suggests a deteriorating ability of the EU's forests to sequester carbon. Related drivers include forest age, temperature effects and natural disturbances worsened by climate change (including pests, storms, and wildfires), harvesting practices as well as mismanagement (ESABCC, 2024a; Hyyrynen et al., 2023), leading to higher tree mortality and lower forest growth. External factors can also be influential, such as the increase in harvesting in Latvia following the energy crisis in 2022 which led to increased biomass extraction for energy generation. At the same time, data quality remains poor with irregular and fragmented measurements, so current data may not fully capture the changes in forest carbon sequestration, nor the impacts of exceptional droughts in the EU since 2015 on forest stands (Forest Europe, 2020).

**Figure 9: Past progress of Member States towards growing the carbon stock in forest land between 2016 and 2021**



Source: FAO (2024). Note: Average growth of carbon stock in forest lands for all EU Member States apart from the Netherlands and Cyprus where no data was reported.

## EU and Member States policies

Forest policy in the EU is fragmented across different levels of governance from the EU to the local level and is weakly institutionalised at the EU-level, related to the fact that the EU has few competencies in this area (Elomina & Pülzl, 2021). Forest policy remains a competence of Member States under the subsidiarity principle with the EU being able to influence forestry practices in particular through its targets, guidance and financial support.

### EU policies

Current EU policies seem insufficient to deliver the required increases in forest carbon storage in the context of the **LULUCF Regulation**. The Regulation guides the development of natural removals by ensuring they are accurately accounted for through a binding EU target of 310 Mt CO<sub>2</sub> to be stored in 2030 and national net removal targets. In this context, the EC published its **Forestry Strategy** for 2030 (2021g), which sets out the vision and actions required to improve the quantity and quality of the EU's forests, anchored within the European Green Deal. It commits to planting at least 3 billion trees by 2030 and includes measures to improve forest restoration, resilience, and sustainable management. The strategy also emphasises the importance of improving monitoring, making decentralised planning more effective, and proposes reviewing the EU taxonomy criteria for forestry and bioenergy to enhance biodiversity.

The proposed Nature Restoration Law sets a goal to restore 20% of the EU's land and sea areas by 2030. It promotes a rising trend in the presence of standing and laying deadwood, unevenly aged forests, biodiversity and the stock of organic carbon. If adopted, Member States will have to submit Nature Restoration Plans which outline how they comply with the targets. The CAP also supports forests and sustainable management through subsidies. From 2014–2020, the CAP committed subsidies of EUR 6.7 billion for sustainable forest measures, mostly to afforestation (27%), prevention of forest fires and other natural disasters (24%), and investments in ecological, social and resilience functions (19%). The current CAP (2023–2027) provides more flexibility on forestry subsidy design, according to specific national circumstances. The EC (2021g) provided recommendations to Member States on the CAP Strategic Plans to improve sustainable forest management, and to restore forest ecosystem services. The CFCR aims at incentivising afforestation, reforestation and sustainable forest management by certifying carbon removals, but questions remain with regard to ensuring additionality, long-term storage and liability (Meyer-Ohlendorf et al., 2023). Ensuring high-integrity certification is also important for monitoring progress towards the LULUCF Regulation and Nature Restoration Law objectives.

The Renewable Energy Directive (RED III) strengthened sustainability criteria for forest biomass with new limits on its use for burning; however, there are concerns that issues with monitoring, compliance and fraud may undermine the effectiveness of these (ESABCC, 2024a). The EU Timber Regulation (EUTR) aims to prevent illegal logging and trade in wood products in the EU Member States, by establishing obligations on operators and traders of wood products to implement a due diligence system, ensuring that the wood products are legal. The EU Deforestation Regulation (EUDR) ensures that seven commodity products identified as major drivers of deforestation are not sold in the EU if they are sourced from areas affected by deforestation.

Despite these policies, there are a lack of EU-wide rules that apply to Member States for forest protection, afforestation, sustainable forest management practices and payments. The EC (2023c, 2023s, 2023u) provides voluntary guidelines to support national implementation. In addition, the proposal for a Forest Monitoring Law (EC, 2023x) aims to improve knowledge on forest ecosystem services, by providing standardised satellite data and harmonising with data collected by MS.

### Member States policies

The forestry policy framework across Member States is rather difficult to assess as the approach to forest regulation often varies by region. There are many national and regional processes to improve forestry practices, whereby many of these processes are ongoing and/or have not been enshrined to law (Pecurul-Botines et al., 2023). There is a lack of policy coordination particularly within Member States characterised by multiple level and regional governance structures. Forest laws are in place for almost all countries in Europe and generally cover rules on clearing, protection against forest fires or forest pests and on forest practices (Forest Europe, 2020). There are some policies that influence carbon sequestration, but impacts are usually indirect and non-binding. Most Member States seem to promote the growth of forests through targets to increase forest area, plant trees and/or improve sustainable forest management (Lee et al., 2023). Roughly half of these targets are specific and quantitative, however some are unclear regarding timescales, details and implementation plans. The EU (through the Certification Framework for Carbon Removals) and some of its Member States have implemented or are considering voluntary certification schemes for forest carbon removals (Margaras & Jensen, 2022). In the following, we outline some key policies from five MS, which have a direct or indirect impact on carbon sequestration.

**France** introduced a scheme mobilising up to EUR 720 million in investment aid until 2029 to repair and prevent damage to forests, and to plant up to 1 billion trees (DGAL, 2024). The investment aid aims to avoid clearcutting of plantations, which was already an issue under the previous tree-plantation-policy where 87% of the projects financed were clear-cuts, mostly on stands suffering of dieback (Canopée, 2023). Another major policy impacting forest expansion is the low-carbon label (label bas-carbone), a government-backed voluntary scheme for certifying carbon projects either for emission reductions or carbon sequestration (République française, 2018). The programme aims to incentivise the development of emission reduction and carbon removal projects in the agriculture and forestry sectors, among other economic sectors. The programme includes provisions to ensure that the certified carbon units generate a positive climate impact. Projects can be financed through public and private sources. By February 2024, approximately 2.6 Mt CO<sub>2</sub> had been certified (République française, 2024). Around 75 % of this mitigation potential stems from afforestation or reforestation projects (Carbon Gap, 2023b). However, the label has been criticised for several shortcomings common across most carbon certification schemes including inadequately integrating biodiversity preservation into its criteria and not contractually guaranteeing the preservation of carbon stock in case of reversal (Carbon Gap, 2023b; Réseau Action Climat, 2023; Vennin & Angerand, 2023).

In **Germany**, forest management is regulated at the federal and state level. Strategies include the National Forest Strategy 2050 (BMEL, 2021b), the Charter for Wood 2.0

(BMEL, 2021a), and the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity (BMUV, 2023). The Federal Forest Act (BWaldG) provides guidelines for forest subsidy schemes but so far stipulates only very limited mandatory requirements for forest protection. The government's proposed revision of the legislation might include a new focus towards the protection of forests and their ecosystem services and a new forest governance consisting of unified and binding minimum standards, a foundation for payments for ecosystem services and an improved forest information and monitoring framework (BMEL, 2023a; Höllerl, 2023). The Nature-based Solutions programme for forest management distributes approximately EUR 200 million per year to private forest owners complying with 12 sustainability criteria (BMEL, 2023b). The rural infrastructure program 'GAK' provides another approximately EUR 125 million per year towards the forestry sector (BMEL, 2024a). Germany's Forest Climate Fund (BMEL, 2024b) which financed R&D projects for forest protection, climate adaptation, and the development of a forest carbon storage monitoring system since 2013 was recently dismantled. The National Forest Inventory (FRI) provides data on the status and development of Germany's forests including carbon stock, resource management and ownership title. The FRI is updated every 10 years and is supplemented by a national carbon stock inventory every 5 years, and a forest soil inventory every 15 years.

In **Romania**, forest degradation through illegal logging has been declared a threat to national security. Out of more than 6.5 million hectares of forest, less than 3% are protected against any type of logging (WWF, 2020b). In response to the rise in illegal logging in Romania, failure to enforce the EC's EUTR law, and pressure from the EC and the public to end this, Romania introduced new rules to improve the monitoring and transparency of wood harvests. Hence, the decision 470/2014 (amended in 2020) helps to reduce losses in the carbon stock by defining rules on the origin, circulation and marketing of wood products (ClientEarth, 2018). The new rules include a requirement for actors of the wood industry to use an Integrated Information System for Tracking Wood Materials. New sanctions have also been introduced to ensure enforcement (Wikström Avaria, 2023). However, the EC's EUTR and national laws in Romania against forestry crime have up to now not been implemented with full effect due to different gaps and obstacles. These include, for example, problems with control system, judicial inefficiency, corruption, the absence of a forest cadastre, the administrative fragmentation of the national forestry fund, lack of trainings, specialised staff, and low salaries (WWF, 2020a).

**Italy** has a national law (no. 353 of 21 November 2000) that aims to prevent forest fires and hence decrease the impact of these events on GHG emissions. The law sets rules for municipalities and landowners for the management of land affected by fires, in particular for grazing and building. The law also lays out how these areas are monitored.

## Areas of actions

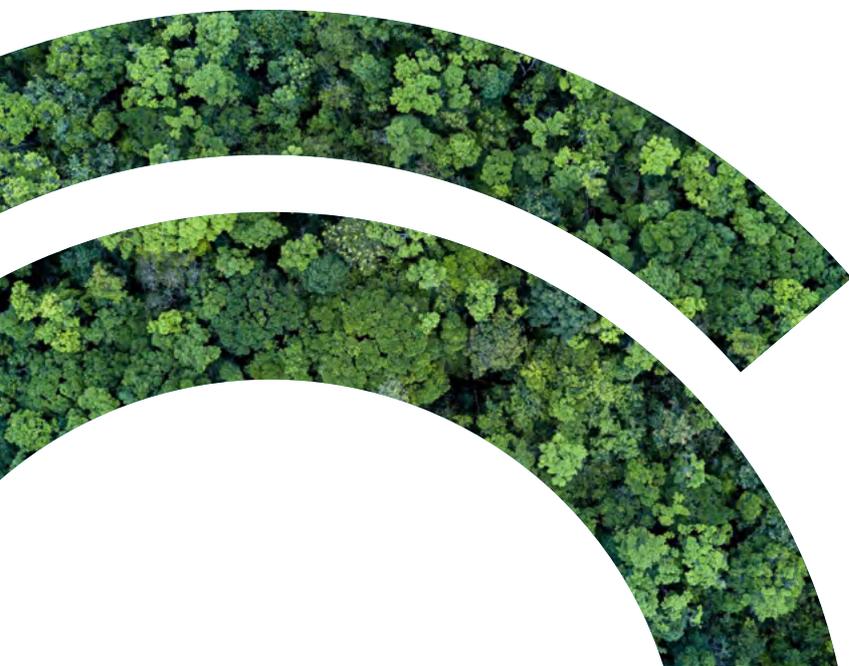
To achieve the LULUCF target and enhance other valuable forest ecosystem services, there is a need to further promote and support forest afforestation, reforestation and sustainable forest management. The EU and its Member States should make best use of the upcoming national Nature Restoration Plans. The EU should follow-up on its own guidance to Member States on sustainable forest practices and their consideration and implementation. The EU

should particularly address the risks of fast growing plantation forests, encouraging a shift away from monoculture forests towards more near-natural forests with a greater mix in tree species, promoting biodiversity and the forests adaptability to climate change (see e.g., ESABCC, 2024a). Adaptation efforts should be improved to address the uncertainties with climate change and its impacts on forest carbon sinks. Forest resilience should therefore be a key element of mitigation plans.

Building on the 3 billion trees initiative, the EU should consider degraded or unused lands for the expansion of forests to new areas (changes to other land uses may also free-up areas for new forests). In this context, it is important that EU policies on agriculture and biofuels reflect the necessity to preserve and expand the area of forests for carbon sequestration (ESABCC, 2024a). It is also important that a restoration-oriented approach is taken towards rich forest ecosystems.

The CAP should be improved with stricter conditionality requirements and eco-scheme and agri-environmental-climate incentives that result in increased removals (ECA, 2021b; ESABCC, 2024a). The impact of the CAP on sustainable forest practices could also be improved by providing capacity building to help landowners implement CAP measures and access funding, while ensuring robust monitoring to ensure that the measures have been implemented.

Any certification of forest carbon removals, such as under the CFCR, must ensure that removals are of high integrity and long-term storage is ensured (Meyer-Ohlendorf et al., 2023). Furthermore, the EU's knowledge and database needs to be improved for forests, based on a strong adoption and implementation of the proposed Forest Monitoring Law. The Forest Information System for Europe (FISE) should be improved to add more comprehensive information on indicators and policies at the Member State level. It is important that data covers ecological, social and health indicators and is easily accessible with regular updates (see e.g., Carbon Gap, 2022).



## 5.3 Channelling public funds away from fossil fuels

EU Member States should urgently publish plans on how and when to phase out fossil fuel subsidies

**Past progress:** Progress towards channelling public funds away from fossil fuels was going in the **wrong direction** in the period assessed. EU fossil fuel subsidies (FFS) have almost tripled between 2021 and 2022 and reached EUR 190 billion (OECD & IISD, 2024). For comparison, subsidies granted to renewable energy amounted to EUR 87 billion in 2022. This growth in fossil fuel subsidies is mainly due to the recent energy crisis, largely generated by the war in Ukraine, which led EU Member States (MS) to adopt more than 230 temporary subsidy measures to protect households and companies from the rise of energy prices (EC, 2022m). It should be noted that even before the energy crisis, FFS were still very high at the EU level and amounted to EUR 68 billion in 2021 already. Italy, France, the Netherlands, and Germany represented 62% of total EU fossil fuel subsidies in 2022 (OECD & IISD, 2024).

**Table 33: Progress towards channelling public funds away from fossil fuels**

Public climate subsidies	
Fossil fuel subsidies	

**Policy context:** The EU's 8th Environmental Action Programme (2022) urged MS to phase-out fossil fuel subsidies as soon as possible. This objective to end all fossil fuel subsidies by 2025 was reaffirmed by European parliamentarians at COP 28 (EP, 2023b). Following the EU's 8th Environmental Action Programme, MS are required to report their action plan to phase out fossil fuel subsidies in their National Energy and Climate Plans (NECPs) on an annual basis. According to these reports, many MS plan to move away from fossil fuel subsidies, but only a few have translated these ambitions into laws or clear plans (EC, 2023a). Denmark is the only MS that translated its objective to phase out FFS into a national plan, while Poland is the only MS that expressed an intention to continue the expansion of fossil fuel extraction.

**Areas of action:** To enable the redirection of financial flows from fossil assets to climate action and limit global warming to 1.5 °C, it is essential that fossil fuel subsidies are replaced by climate subsidies as soon as possible. The EC could for example impose sanctions on MS that do not publish clear plans for phasing-out fossil fuel subsidies. However, it is important to note that these plans should consider the social consequences of ending these subsidies. These sanctions could be applied first to MS that have not drawn up precise plans for phasing-out fossil fuel subsidies, and subsequently to MS that do not comply with the plans they have set themselves. It is up to the European institutions to specify the procedures and timetable for these sanctions.

## A closer look at past progress

In the EU, public investments account for a significant share of the economy. Fossil fuel subsidies given by EU Member States reached 1.2% of EU GDP in 2022, which represents EUR 190 billion (OECD & IISD, 2024). This amount has tripled since 2021 (excluding inflation), even though MS are supposed to phase-out fossil fuel subsidies as soon as possible according to the EU's 8th Environmental Action Programme. While the increase in fossil fuel subsidies is partly cyclical, corresponding to governments' responses to the rise in energy prices, few MS have indicated clear dates for phasing-out fossil fuel subsidies or specified plans for doing so. The EU cannot meet its climate targets if MS continue to subsidise fossil fuels (see 4.9). Besides, fossil fuel subsidies incentivise investments in fossil fuels, thus lock in related emissions over a long period, and scarce the public finance that is needed to trigger the transition.

### Fossil Fuel Subsidies

Fossil fuel subsidies (FFS) almost tripled between 2021 and 2022 and reached EUR 190 billion (OECD & IISD, 2024). This growth in fossil fuel subsidies is mainly due to the recent energy crisis, primarily generated by the war in Ukraine, which led MS to adopt more than 230 temporary subsidy measures to protect households and companies from the rise of energy prices (EC, 2023a). Almost all MS saw their total FFS increase in 2022, with the exception of Finland, Romania, Luxembourg, and Bulgaria. Italy, France, the Netherlands, and Germany represented 62% of total EU fossil fuel subsidies in 2022 (OECD & IISD, 2024).

According to a study prepared for the EC by Enerdata (EC, 2023an), 83% of EU FFS in 2022 were allocated to support energy demand, e.g., by limiting the cost of energy consumption with lower tax rates on energy products. 20% of EU FFS were allocated to households (EC, 2023an).

Italy accounted for 25% of total EU FFS in 2022 (OECD & IISD, 2024), while representing 12% of the EU's GDP and 13% of the EU population (Eurostat, 2023g, 2024h). Italian FFS more than tripled (excluding inflation) between 2021 and 2022 reaching EUR 47.6 billion – 2.4% of its national GDP (Eurostat, 2024h; OECD & IISD, 2024). Until 2021, the main forms of support were tax exemptions for diesel, kerosene, and petroleum products, with the objective to support especially freight and passenger transport, agriculture, and fisheries (EC, 2023an). In 2022, the Italian government set up several measures to contain an increase of electricity and gas prices for households and companies. The value added tax (VAT) on natural gas dropped to 5%, as did the VAT on petrol and diesel for cars. Other measures were implemented, such as a tax credit to partially compensate the extra costs due to high electricity and gas prices, the installation of a social bonus on electricity and gas for low-income households, and a discount or exemption on the general system charges on gas electricity for households and businesses (Bruegel, 2023; IEA, 2023c).

France is the second largest contributor to the rise of FFS in the EU in 2022, after Italy (in absolute value). French FFS amounted to EUR 27.7 billion in 2022 – 1.1% of France's GDP, which is three times more than in 2021 (OECD & IISD, 2024). The primary factor of this increase is the implementation of a tariff shield by the government to assist

households and businesses in dealing with the escalating energy prices. In 2022, the French government allocated EUR 8 billion as a discount on fossil fuel prices for cars to households and companies. This measure was a one-off and will not be replicated in 2023. The French government also spent EUR 6.7 billion on a tariff shield on gas prices. This shield consisted of the state compensating gas distribution companies for the losses, which incurred because of the nationwide gas price freeze introduced by the state in 2021. These two measures explain 78% of the total rise in 2022 (Direction Générale du Trésor, 2023).

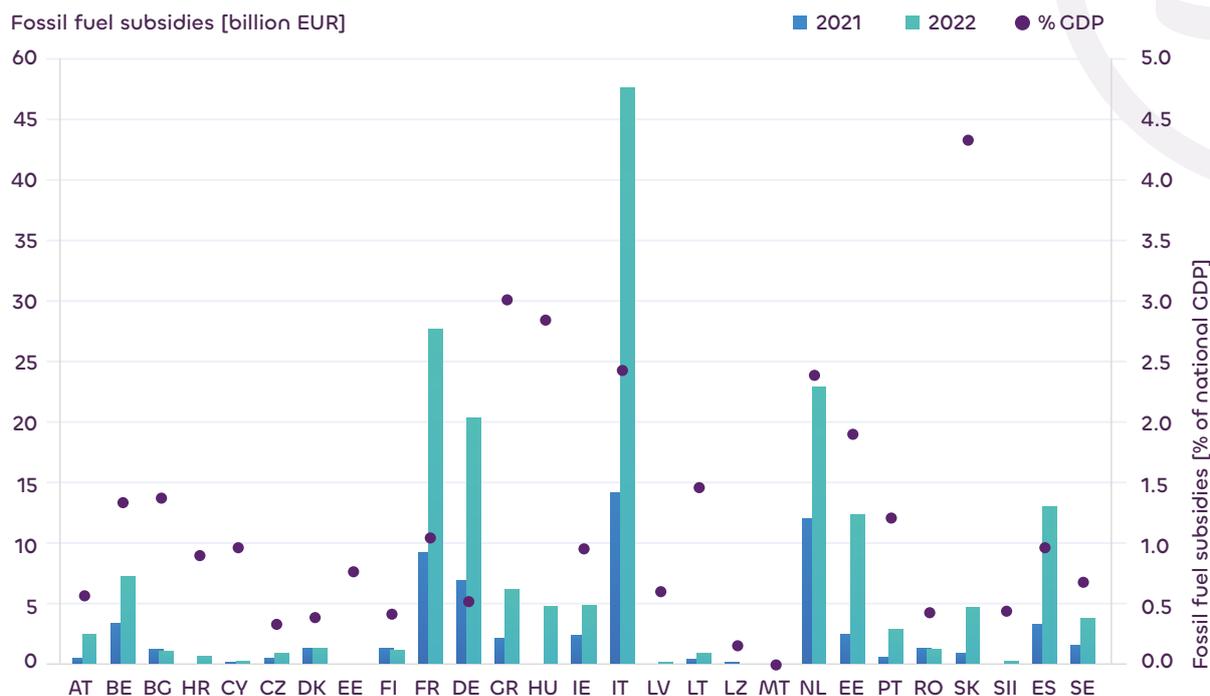
In terms of percentage of GDP, Slovakia has the highest share of FFS (4.3% of national GDP in 2022 versus 0.9% in 2021), followed by Greece (3.0% in 2022 versus 1.2% in 2021) and Hungary (2.8% in 2022 versus 0.1% in 2021). For each of these countries, the increase in FFS is also primarily due to the support measures implemented in response to the increase in energy prices (EC, 2023a). In Slovakia, the government has earmarked EUR 1.4 billion in 2022 in aid to support businesses in response to increasing energy costs and EUR 500 million to compensate electricity and gas producers for price caps. The Slovak government also spent EUR 1 billion as an anti-inflation package in 2022 to help households facing the rise in electricity and gas prices (Bruegel, 2023). In 2022, 18% of Slovakia's electricity production was generated from fossil fuels (IEA, 2024d). Therefore, some of the aid provided in response to increasing electricity costs can be considered as FFS.

In Greece, until 2021, most FFS concerned tax expenditure (foregone revenue), especially post-retirement benefits for public power corporation pensioners and employees and reduced excise taxes on diesel used for heating. In 2022, Greece introduced new or significantly expanded measures that support the consumption of heating oil, gas, diesel, and gasoline (IEA, 2023b). In May 2022, the Greek government announced a EUR 3.2 billion package to relieve pressure on household budgets and businesses from soaring energy prices. From the end of 2021 until mid-2022, the government spent EUR 2.5 billion in power and gas supply. In the winter 2022 to 2023, additional aid of EUR 1.1 billion was paid to households and businesses to shield them from rising energy prices (Bruegel, 2023). In 2022, 54.4% of Greece's electricity production was generated from fossil fuels (IEA, 2024b). Therefore, a significant share of the aid provided in response to increasing electricity costs can be considered FFS.

Until 2021, Hungary had minimal FFS, accounting for only 0.1% of national GDP. However, in 2022, this increased significantly reaching EUR 4.8 billion, a 30-fold increase compared to 2021 (OECD & IISD, 2024). These subsidies primarily aimed to assist households and businesses in managing the rising costs of electricity and gas. They also included the state's response to the energy security crisis that the country was facing due to the war in Ukraine. In 2022, 33.3% of Hungary's electricity production was generated from fossil fuels (IEA, 2024c). Therefore, a non-neglectable share of the aid provided in response to increasing electricity costs can be considered as FFS. The government also implemented measures to increase domestic natural gas production to 2 billion cubic meters and to look for additional sources of gas, in order to reduce dependence on Russian gas exports (Bruegel, 2023).

It is important to note that the 2022 rise is mainly explained by the implementation of one-off measures by MS to contain the rise in energy prices for households and businesses. It remains to be seen if the total amount of FFS will return to 2021 levels or less. However, it should furthermore be noted that even before the energy crisis, FFS were very high at the EU level amounting to EUR 68 billion in 2021 already.

**Figure 10: Past progress of Member States on fossil fuel subsidies**



Source: OECD & IISD (2024), Eurostat (2024r).

## EU and Member States policies

### EU policies

As stipulated in the EU’s 8th Environmental Action Programme (2022), MS should phase-out FFS as soon as possible. The objective to end all FFS by 2025 was reaffirmed by European parliamentarians at COP 28 (EP, 2023b). As the amount of FFS in the EU tripled between 2021 and 2022, it is now more important than ever for the EU to push for a swift return to and action on those commitments.

More specifically, the EU urged MS to phase-out FFS at the Union, national, regional, and local level without delay, setting a deadline and imposing a binding framework to monitor and report on their progress (EU’s 8th Environmental Action Programme) in their NECPs. These reports outline that almost all MS plan to phase-out FFS, except for Poland that has plans to expand fossil fuel availability and use. Bulgaria and the Czech Republic do not mention any FFS phase-out. Several countries, such as France, Germany, Italy, Latvia, Lithuania, and Luxembourg publicly reconfirmed their commitment to an economy-wide phase-out of FFS. The power sector is the sector where MS have the most concrete plans

to phase-out their FFS, especially for coal. Eight MS have also set dates to phase-out FFS in the building sector. However, for the other economic sectors, such as industry, transport, and agriculture, an end-date of FFS is completely absent.

The EC urged MS to provide more transparency on end-dates for FFS. According to the Commission, the absence of information on end dates for these subsidies makes it difficult to assess whether the EU is **on track** regarding its climate objectives (EC, 2023a).

Finally, the Energy Taxation Directive (2003) still allows fossil fuel subsidies through tax exemptions for certain sectors, in particular for commercial shipping, aviation, and the fisheries sectors. This text is currently being revised by the European institutions, with the possibility of ending these exemptions.

### Member States policies

Among MS, **Denmark** is the only country that has set out a comprehensive national plan to concretely phase-out all FFS. In 2022, the Danish government presented its political framework for phasing-out fossil fuel subsidies and establishing a new Green Fund (EC, 2023h). As part of this, Denmark committed itself to completely phase-out FFS related to electricity generation and coal-fired power plants, as well as support in fossil heating systems in the building sector (EC, 2023an). Denmark is one of the countries with the best practice so far, even if more transparency on the FFS end date is still needed. However, Denmark only represents 0.8% of total EU FFS, amounting to a total of EUR 1.6 billion in 2022 (OECD & IISD, 2024).

**France** committed itself to end all FFS but without setting a date to do so. As reported in its last NECP update, France is planning to phase-out 60% of its FFS by 2025 (EC, 2023an). More specifically, France plans to eliminate the tax gap between the reduced tariff and the normal tariff for petroleum products (excluding natural gas and coal) consumed by energy-intensive businesses, and coal consumed by energy-intensive businesses exposed to international competition by 2024. It also plans to eliminate the tax gap for non-road diesel between 2024 and 2030 and for diesel used by agricultural machinery by 2030. In addition, the French government committed itself to reduced excise tariffs on coal used by energy-intensive installations, as well as to an alignment of the standard jet fuel tariff and the excise tariff for aviation petrol with the tariff applicable to road petrol in 2024. However, France did not commit to an end date for FFS in the buildings, transport, and agriculture sectors (EC, 2023p). France represented 15% of total EU FFS in 2022, amounting to a total of EUR 29.2 billion (OECD & IISD, 2024).

**Germany** also committed to ending all FFS but without setting a date to do so. As reported in its last NECP update, Germany is planning to phase-out 50% of its FFS by 2025 (EC, 2023an). Germany plans to end subsidies for early retirement of outgoing coal workers (adaptation allowance) that will expire at the end of 2027. Post-decommissioning activities were subsidised up to and including 2022 (EC, 2023q). Germany also indicated an end date for FFS in the buildings sector, but not for the transport and agriculture sectors (EC, 2023an). Germany represented 11% of total EU FFS in 2022, amounting to a total of EUR 21.4 billion (OECD & IISD, 2024).

Unlike Denmark, France, Germany and other MS, **Poland** has not committed to phasing-out FFS at all. Poland is also the only country that has not given any consideration on phasing-out coal-based electricity. The government has an agreement with the Polish Mining Company to maintain hard coal mining operations until 2049. The Polish government expressed the objective to expand the availability of fossil fuels and diversity of its supply through the development of new infrastructure for natural gas, LNG, and oil (EC, 2023an). Poland can thus be considered one of the worst performers regarding plans to phase-out FFS. Poland represents 7% of total EU FFS (while representing 4% of the EU's GDP), amounting to a total of EUR 12.5 billion in 2022 (OECD & IISD, 2024).

## Areas of action

To enable the redirection of financial flows from fossil assets to climate neutral ones and limit global warming to 1.5°C, it is essential that fossil fuel subsidies are replaced by climate subsidies as soon as possible.

As stipulated in the EU 8th Environmental Action Programme (2022), MS should provide a 'binding Union framework to monitor and report on Member States' progress towards phasing out fossil fuel subsidies, based on an agreed methodology' and set 'a deadline for the phasing out of fossil fuel subsidies'. These MS plans should appear in their NECPs. Most of the MS expressed their intention to move away from fossil fuel subsidies but did not necessarily translate this intention into concrete plans with clear end dates (EC, 2023a).

If the European institutions want the Environmental Action Programme to be effective regarding the FFS phase-out, e.g., they could impose sanctions on MS that do not publish clear plans, including end date, for phasing-out all FFS. These plans should include clear end dates for FFS in all relevant sectors, not only for FFS given to coal-fired power plants, but also for all electricity generation based on fossil fuels (including natural gas), as well as for the industry, the transport sector, the heating systems of buildings, and the agriculture sector.

These sanctions could be applied first to MS that have not drawn up any precise plans for phasing-out fossil fuel subsidies, and subsequently to MS that do not comply with the plans they have set themselves. It is up to the European institutions to specify the procedures and timetable for these sanctions. However, it is important to note that these plans should take into account the social consequences of ending these subsidies.

The EU should also revise its Energy Taxation Directive to exclude the tax exemptions for fossil fuels in the aviation and maritime sectors.

## 5.4 Creating job opportunities

Potential not (yet) fully realised

**Past progress:** The EU was able to create significantly more job opportunities as part of the transition towards climate neutrality in the last few years. The employment rate in regions most affected by the transition was not only the highest on record in 2022 (Eurostat, 2024d), but is also **on track** to meet the objective set by The European Pillar of Social Rights Actions Plan (at least 78% by 2030 in the entire EU (EC, 2021o)). There is room for further improvement as inequalities between regions remain. For employment in the renewable energy sector, the dynamics accelerated in 2022, and the indicator was on the verge of begin assessed as **on track**. In the employment in relevant environmental goods and services, there was progress too, with now over 1.7 million people in the EU working in the sector; however, the pace of growth needs to increase to meet the needs of the changing labour market.

**Table 34: Progress on creating job opportunities**

Employment rate in regions	
Employment in Environmental Goods and Services	
Employment in all Renewable Energy Sources	

**Policy context:** The EU has a complex policy framework to support employment. The key policy measure in ‘regions in transition’ is the Just Transition Mechanism (JTM). Beyond the JTM, there is also the Effective Active Support to Employment (EASE): guidance to Member States (MS) on active labour market policies and their funding. To support employment in the emerging green energy sector, the EU has over 10 funding instruments (ESABCC, 2024), including the European Skills Agenda and RePowerEU with its sectoral strategies such as the EU Solar PV Alliance and the BUILD UP skills initiative. Several good practices examples also exist at the MS level, such as the ‘Green Skills and Jobs Programme’ in Portugal.

**Areas of action:** An effective policy tool to further support (green) job creation would be the introduction of specific and ambitious sector targets, both at the EU and MS level. Another priority area should be to adjust skills available in the labour market to the needs of rapidly growing - and changing - sectors fundamental to the transition to climate neutrality. The first step in this direction would be a state-led, systemic gathering of data on shortages of skilled professionals in each key transition profession, and the use of this data to create adequate training programmes (SolarPower Europe, 2023).

## A closer look at past progress

The transition to a climate neutral economy, if planned and facilitated well, offers a unique opportunity for the large-scale creation of new, good-quality jobs for all citizens (EP, 2023a). However, if underestimated in its challenges, it can also pose risks to existing employment – in particular, in regions dependent on economic sectors which undergo particularly deep transformations. This analysis aims to better understand how effective the EU is in both the creation of new job opportunities and transitioning the existing workplaces.

Three employment-related indicators inform this analysis. Two of them refer to state- and EU-wide changes in employment related to the emergence, changes in and/or growth of sectors directly engaged with the transition: ‘employment in the renewable energy sector’ covers direct and indirect employment in this key area of the transition; ‘employment in environmental goods and services’ is a broader indicator, which shows progress within the following three areas as defined by Eurostat: CEPA 1: ‘Protection of ambient air and climate’, CReMA 13A: ‘Energy from renewable sources’, and CReMA 13B: ‘Energy savings and management’. The third indicator, ‘employment rate in regions’, covers progress not only in green jobs creation but also takes into account all employment opportunities in the regions considered, and serves as a proxy for their overall economic development – the regions of the EU which have been identified as carbon-intensive, as well as deemed eligible for the Just Transition Fund (JTF) (EC, 2020l).

### Employment rates in regions most affected by the transition

In 2022, the employment rate among the population between the ages of 20 and 64 in the EU regions most affected by the transition was 74.2% (Eurostat, 2024d). This number was very close to the employment rate for the whole EU, which was at a record-setting high level of 74.6%. These numbers lead to two significant positive conclusions: firstly, employment in the EU as a whole has recovered from the sudden fall caused by the COVID-19 pandemic in 2020, and secondly, regions most affected by the energy transition are not being left behind in this progress. Notably, the pace of employment growth in the ‘regions in transition’ is also **on track** with the objective of reaching the EU’s overall employment goal of at least 78% by 2030 in the entire EU set by The European Pillar of Social Rights Action Plan (EC, 2021o). The level and the fast pace of improvement of the indicator after the crisis of 2020 could be a signal that key policies at the EU level, such as the above-mentioned Action Plan together with the JTM, have started proving successful in steering the EU’s labour-related strategy towards objectives based on solidarity and fairness. Nonetheless, the work is not yet done and key challenges remain as discussed in the following sections.

## Trends on a national and regional level

In 2022, despite the overall positive trend of progress, certain inequalities between MS and regions remained and should not be overlooked by policy-makers. Notably, however, the lines of the inter-state and inter-regional inequalities do not seem to correspond with the extent to which the regions are affected by the energy transition: Regions identified under the JTF as most affected by the transition can be found on all sides of the spectrum of regional employment rates. Some JTF regions such as Groningen in the Netherlands (80.9%), Brandenburg in Germany (82.1%), or Łódzkie in Poland (78.6%) significantly exceed EU's average employment rate (74.6%) (Eurostat, 2024f). These, and other 'regions under transition' with employment rates above the EU's average are largely in states whose national rates are also exceeding the average, which suggests that policies and other factors which function at a national level – rather than the JTF region-specific support – have thus far had the largest impact on those regions.

On the other hand, the regions most affected by the transition to climate neutrality with employment rates below both the EU average and the averages of their respective countries are often the ones for which support from the JTF has only launched recently. Hence, there is potential for rapid targeted improvement once the funds are put to use, and the accompanying measures are implemented locally. Examples of such regions are 1) Western Macedonia in Greece, with an employment rate of 58.8% (with a rise of only 4.2 percentage points since 2018, while the Greek national employment rate is 66.3%), and 2) Sulcis-Iglesiente in Sardinia, Italy, which in 2022 recorded an employment rate of 58.6% (only 2.5 percentage points more than in 2018, while the whole of Italy recorded a rate of 64.8%). Western Macedonia and Sulcis-Iglesiente have only been included in the JTF and began the implementation of the Territorial Just Transition Plans, in 2023 and 2022 respectively, meaning that the latest labour market statistics from 2022 will not yet have captured the progress that might have been facilitated by these funds more recently.

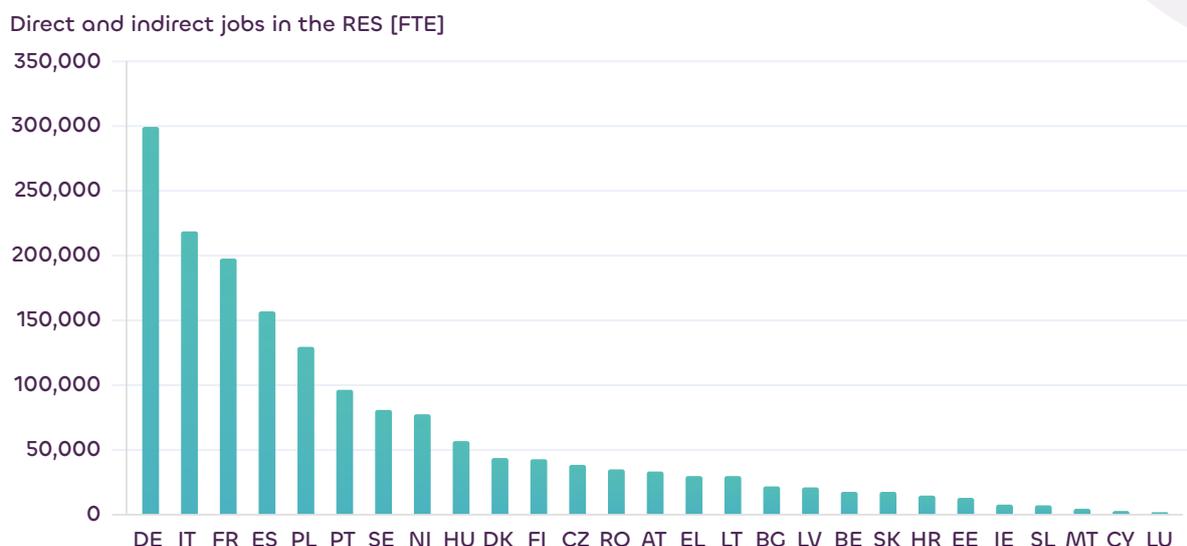
## Employment in the renewable energy sector

Naturally, a sector that has great potential in terms of job creation during and after phasing out fossil fuels is the sector of renewable energy sources (RES), such as wind power, photovoltaic, solar thermal, heat pumps, and more (EurObserv'ER, 2023). The most recent data concerning employment and job creation in RES in the EU include data up until 2022 and shows an average annual increase of 4.6% between 2017 and 2022. This development was moving in the right direction but still marginally **too slow** to be classified as **on track** with climate neutrality goals.

That said, the total direct and indirect employment in the RES sector was 15% higher in 2022 than in 2021, totalling an estimated 1.69 million full-time equivalents (EurObserv'ER, 2024) and demonstrating a high potential for exponential growth in these sectors. Progress has also been spread throughout the EU, with 20 out of 27 MS having either maintained or increased their number of renewable energy jobs compared to the previous year. The MS which experienced the largest growth from 2021 to 2022 was Portugal (+46,400 new jobs, a 92% increase), whose notable progress has been largely due to the completion of one of the country's largest hydropower plants at the Tâmega energy storage complex in northern

Portugal. Following Portugal, the greatest increases were seen in Germany (+42 200 new jobs, a 16% increase), and Spain (+32,400 jobs, a 26% increase), both of whose highest-emplying renewable energy sectors were photovoltaics and wind. The most significant progress in employment per technology was noted for photovoltaics (PV) (+123,800 jobs, a 55% increase compared to 2021). This has been largely due to an ample increase in newly installed capacity in Germany after the beginning of the 2022 fossil fuel crisis, resulting in 31,100 new full-time jobs in the photovoltaic sector. The boom in PV production capacity was also observed in Denmark, Hungary, and Sweden, which together contributed to a total of 34,900 new jobs in the sector.

**Figure 11: Gross employment in all RES in EU Member States in 2022**

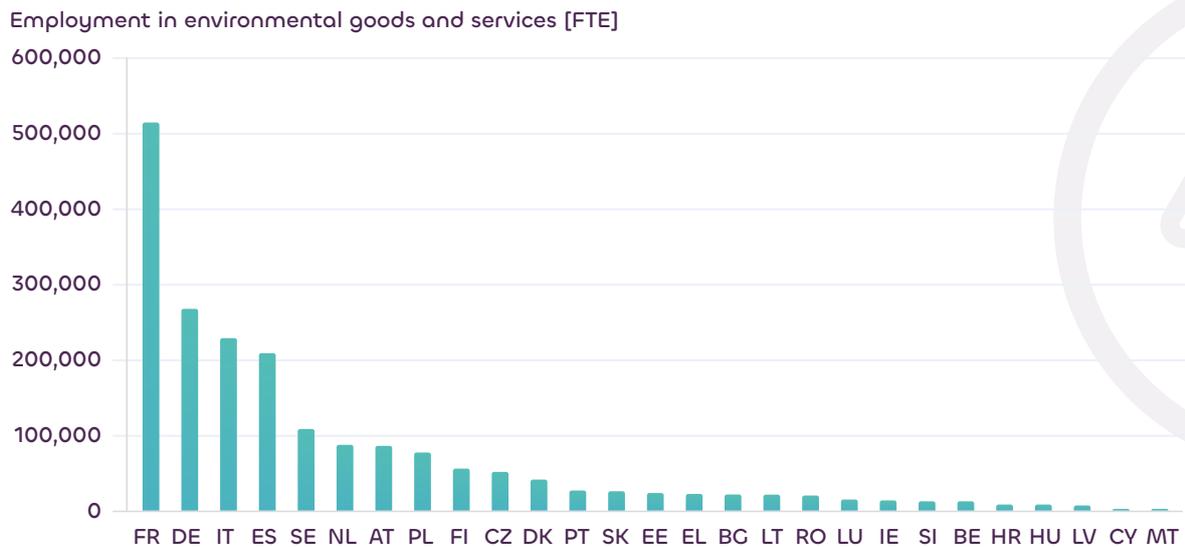


Source: (EurObserv'ER, 2023)

### Employment in environmental goods and services

‘Employment in environmental goods and services’ measures job creation in three sectors identified by Eurostat: 1) ‘Protection of ambient air and climate’ (CEPA 1), 2), ‘Production of energy from renewable sources’ (CReMA 13A), and 3) ‘Heat/energy saving and management’ (CReMA 13B) (the latter have been classified by Eurostat together as ‘Resource Management Activities’ up until 2024 (CReMA)) (Eurostat, 2024e). This indicator concerns only direct employment, but in a wider scope of activities than previously analysed. Official EU data is only available in those separate subcategories and the most recent data for all is from 2020, so it is not expected to reflect the recent fast growth in RES sectors yet.

Employment in these three subsectors combined grew steadily at the average annual pace of 3.7% between 2015 and 2020. Yet, the dynamics were different for each of them: For the jobs related to the protection of ambient air and climate, a decline through 2017 was followed by a consistent, yet rather slow, growth in employment that continued until 2020. Jobs in the production of energy from renewables have only grown from 667,000 in 2015 to 697,000 in 2020, with notable drops along the way in 2017 and 2018. Simultaneously, the number of jobs in energy saving and management has experienced solid growth from 869,000 in 2015 to over 1.2 million in 2020 (Eurostat, 2024e).

**Figure 12: Employment in environmental goods and services by Member States in 2020**


Source: (Eurostat, 2024e)

## EU and Member States policies

Creating new, green, and good-quality jobs in the process of building a climate neutral economy is an endeavour which falls within the sphere of competencies of various policy areas. The legislation at the EU level often sets the tone for national policies by establishing EU-wide objectives, such as employment and up/re-skilling targets, while the MS set the national employment goals and have decisive authority in the implementation and design of specific policies.

### EU policies

The EU-level policies regarding job creation can be broadly divided into two categories: firstly, there is the policy area focused on developing the green energy sector and creating new jobs within it, and secondly, there are policy mechanisms aimed specifically at improving employment opportunities for workers from the fossil fuel and other high-emitting industries ('just transition policies', largely focused on the regions most affected by the transition). In both categories, EU policies seem to be setting the tone for broader policy actions on the national and regional level.

It is worth noting that the most recent data available for the indicator 'employment rate in regions' and 'employment in the renewable energy sector' come from 2022, while for 'employment in environmental goods and services', the data still comes from 2020. It is therefore not possible to assess the impact of some of the key policies discussed below as, certain regions have only been included in the JTM in the last two years and other significant policies such as the Effective Active Support to Employment (EC, 2021a) have only been introduced in the last few years.

The key legislation comprehensively addressing the reality of the transition to climate neutrality is the Fit for 55 package, which offers regulatory changes in all sectors of the EU's economy to align them with the commitment to reduce GHG emissions by at least 55% by 2030 (EC, 2021c). Under such legislation, it is expected that a profound shift in the structure of the labour force between sectors, occupations, regions, and required skillsets will emerge. (ESABCC, 2024). Particularly, a significant shift in required skills is expected as interpersonal communication and digital technology use skills will be most in demand, whereas the demand for skills related to the use of traditional tools and technologies will decline (Bongrovi et al., 2023).

In preparation for such notable changes in skills demanded by the labour market, as per July 2023, the EU had 13 funding instruments for upskilling and reskilling (ESABCC, 2024). Key ones are the European Skills Agenda (EC, 2020j), the JTM, RePower EU with its sectoral strategies such as the EU Solar PV Alliance, the The Recovery and Resilience Facility (RRF), the InvestEU Programme, the BUILD UP skills initiative, the European Social Fund Plus, and Erasmus+. The year 2023 was also termed 'The European Year of Skills' to promote action to improve and expand the skillsets of the workers. As a result, thousands of initiatives enhancing skill development were held around the EU in 2023 (EC, 2024k).

In the category of facilitating the employment of workers in regions, a key legislation is the JTM. It aims at preventing potential negative socio-economic impacts in regions so far dependent on carbon-intensive production, which makes them vulnerable during the transition to climate neutrality. The JTM is set up to mobilise around EUR 55 billion to alleviate the economic burden of the transition where it is expected to appear. Spending of these funds is programmed in Territorial Just Transition Plans. Thus, a range of employment-related policy measures (from retraining people to attracting new investments in the regions) will receive support. It is worth noting that even though the distribution of the funding from the JTM follows the top-down approach, the measures are designed in line with the bottom-up approach, so that they are highly adjusted to the specific needs of the region obtaining the funds. Beyond the JTM, there are policy measures such as EASE, which includes a variety of measures that support reskilling, hiring and transition incentives, entrepreneurship, as well as enhanced support by employment services for job transitions.

## Member States policies

The good practice policy examples from different MS described in the following sections are highly differentiated. This fact is a consequence of MS carefully designing their policy tools to make them best suited to address specific challenges arising in targeted communities or sectors. To develop such tailored measures that effectively deliver the expected effects, a wide variety of stakeholders needs to be engaged in the public consultation process at all stages, from conceptualisation to implementation.

**Portugal:** A good practice policy example from Portugal is the 'Green Skills and Jobs Programme' ('Programa Trabalhos e Competências Verdes') introduced in 2023 under the National Energy and Climate Plan (NECP), which is expected to positively impact employment in green jobs (CEPS, 2023). The programme aims at 'reskilling and upskilling employees of enterprises directly or indirectly affected by increased energy costs, as well as the

unemployed’, and its offer targets concrete gaps in people’s skills. The courses have been developed in cooperation between the Agency for Energy, the Portuguese Renewable Energy Association, and the National Agency for Qualification and Vocational Education and Training and implemented nationwide by the public employment services (PES) (CEDEFOP, 2021).

**Austria:** A case of an innovative direct employment initiative is Austria’s Job Guarantee Pilot Project in Marienthal (MAGMA). The region of Lower Austria, which is where the programme took place, has been identified as significantly impacted by the energy transition and is supported by the JTF. The three-year model project was launched in October 2020 and provides a guaranteed job to all residents of the Gramatneusiedl municipality who have been either long-term unemployed or at risk of long-term unemployment. The programme is voluntary, but no one who was offered a job has declined the opportunity of employment. Notably, the jobs created have not only been in the emerging green energy sector. The analysis from 2023 has shown that the MAGMA project has led to positive effects, both economic and non-economic, including an increase in the employment rate as well as benefits to participants’ financial situation, health, self-efficacy, and social inclusion (OECD, 2023). No negative employment spillovers have been found either (Kasy & Lehner, 2023).

**The Netherlands:** The Dutch programme for ‘greening apprenticeships’, launched in 2022, aims to support employment in sectors and professions involved in the energy transition (CEDEFOP, 2021). The Foundation for Cooperation on Vocational Education, Training and the Labour Market (SBB), along with the Employee Insurance Agency and the Social Economic Council, published a report assessing the types and number of jobs which will be demanded to meet the national objectives concerning climate, energy, and housing. The report has identified 46,000 job vacancies in key sectors, primarily for professionals who ‘prepare work and make calculations for building and installation techniques,’ as well as plumbers and fitters, carpenters, electricians, and fitters of electrical installations. Having established the labour demand, the SBB has since functioned as a platform for education institutions and businesses to connect, and for the former to align their offer in terms of vocational training with the needs of the industry.

**Ireland:** Another case of a MS initiative for bridging the gap between the newly demanded skills in emerging sectors and people’s qualifications is the Green Skills Programme established in 2021 in Ireland (CEPS, 2023). Its key element is support for ‘further education and training’ (FET) which aims at preparing workers for the challenges of the transition and hence, building resilience of individual enterprises and the economy as a whole. FET consists of three main pillars: ‘green skills for life’, which focuses on promoting and enabling access to FET courses for all, ‘green skills for construction’ which contributes to decarbonising the construction sector through relevant upskilling programmes, and ‘green skills for careers’ which covers non-construction apprenticeships focused on green skills as well as promotes general re- and up-skilling of workers and unemployed people. The programme is primarily funded through the National Recovery and Resilience Plan and EUR 225 million are devoted to FET.

**Romania:** As a follow-up to the successful programme of Renewable Energy School of Skills (RESS) in Constanta, which trained over 5,000 highly qualified wind energy technicians in Romania, in 2021, the Romanian Wind Energy (RWEA) set up a training academy in a former coal region (IEA, 2023e). The Academy was set up in Valea Jului, which is part of Hunedoara County, one of Romania's regions supported by the JTF. As wind energy installations are on the rise in Romania, projects such as this one aim at preparing the most affected communities for shifts in the labour market. 'The intention of the academy is to retrain up to 800 coal miners as technicians in the renewable energy and energy distribution fields annually, for a total of 8 thousand technicians over the ten years of the project' (IEA, 2023e). The trainings focus on skills such as wind turbine blade repair, photovoltaic panel installation, and safety.

## Areas of actions

A key element, which must remain a priority in EU policy-making, is matching the skills of workers (both in and out of employment at the time) with the fast-changing needs of the labour market. Various reports point to the risk of increasing incompatibility between people's qualifications and the skills currently in demand in the labour market as the transition progresses (CEDEFOP, 2021; SolarPower Europe, 2023). For example, in the solar power industry alone, it is expected that 1.2 million jobs will be created in the EU in this sector by 2027, doubling the employment in the sector within five years (SolarPower Europe, 2023).

To enhance the effectiveness of existing policies in the area of skills, precise data on shortages of skilled professionals should be gathered on the EU level and used as input in designing adequate training programmes (SolarPower Europe, 2023). Beyond policies focused on re-/up-skilling workers in 'green' skills, measures such as addressing Europe's structural lack of technical workers throughout the education system as well as adjusting policy around migration of workers will be key to bridging the skills gaps fast. An improvement of future labour market outcomes can be facilitated by preparing detailed national-level analysis of expected changes in labour market demand and adjusting national educational offers, so that they are compatible with the results of the analysis. To attract more workers to the sectors expected to prosper during the transition, accessible and inclusive career guidance programmes should be further established and promoted, including an 'awareness-raising component' (CEDEFOP, 2021). Another persistent policy gap regarding skills is insufficiency of transition schemes for workers in the fossil gas sector (ESABCC, 2024). More such programmes should be provided on the national level, directly targeting the affected groups. Skills-enhancing projects should also aim at strengthening the ability of public administrations to implement climate-related policies and investments (ESABCC, 2024). Some key sectors, such as buildings and agriculture, are characterised by low participation in skills training (ESABCC, 2024), so more efforts are needed to better target workers and managers with information about programmes that provide advice on increasing the sustainability of production in these sectors.

The transition of workers – and regions – requires not only skills- and education-related efforts, but also economic and social structural changes (including infrastructure building, economic development of regions and nations, and creating new job opportunities – not only in green sectors). EU policy action in this respect is comprehensively covered by the JTM. However, it will be essential to continuously evaluate the JTM’s success in bringing about the expected results, and potentially increase its funding basis (as well as the complementary MS funding) if necessary.

Existing policies regarding (green) job creation – both at the EU and MS level – require targets that are both more specific (such as targets for given sectors in line with the decarbonisation plans) and ambitious (especially in terms of their timeline and pace of progress). It is also crucial for policy-makers to be up to date with current progress towards targets, to track the implementation and to measure the effectiveness of policies introduced. This effort in tracking real-life changes should be undertaken also for the specific target areas which are not aligned with regions used by Eurostat in nomenclature of territorial units for statistics (NUTS). For now, it is not fully possible, as most borders of regions covered by the JTM do not correspond with the statistical regions such as NUTS2 or NUTS3 (with NUTS2 regions usually have between 800,000 and 3 million inhabitants and NUTS3 between 150,000 to 800,000), and therefore there is no region-specific data on many key labour market outcomes.



# 6 Research approach

## 6.1 The indicator-based framework

ECNO uses an indicator-based framework that tracks progress in economic sectors and cross-cutting policy areas, i.e., the **'building blocks'** of a climate neutral future. Building blocks can be categorised into two groups: (1) sectoral building blocks, which represent the key GHG emission categories, and (2) cross-cutting building blocks, which drive GHG emission reductions across the sectors ([see Figure 13](#)).

ECNO's building block selection, or some constellation thereof, is commonly found in EU Member States' long-term strategies and is often referred to in the climate policy literature (EC, 2018, 2020l, 2024q; IPCC, 2018; Pestiaux et al., 2018; Tsiropoulos et al., 2020a; Velten et al., 2022). Monitoring activities at the global as well as national level also use similar approaches (e.g., Schumer et al., 2022; UKCCC, 2022).

Figure 13: Building blocks for the transition to climate neutrality



Source: ©ECNO based on previous work by Velten et al. (2021)

Within each building block the ECNO experts have defined objectives and enablers.

**Objectives** outline what the building block must achieve to support the overall climate neutrality goal, while **enablers** are the supporting underlying conditions needed to meet the objectives in each building block. Enablers thus reflect on the *drivers* of and *barriers* to decarbonisation and, as such, can provide an early sense of progress – or lack thereof.

### What is an enabler?

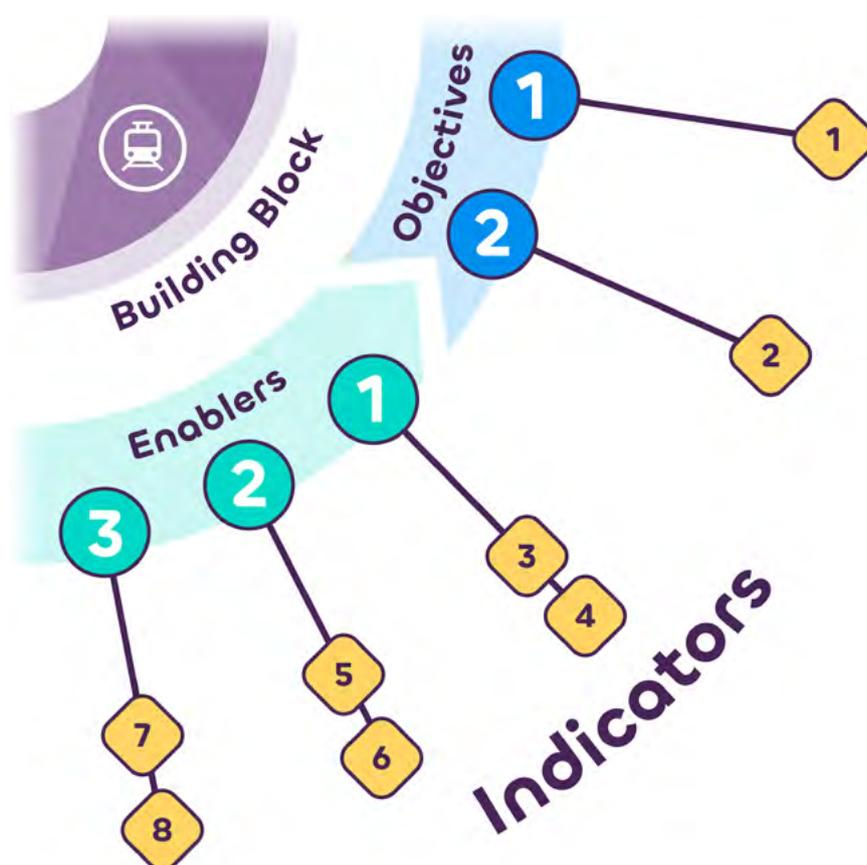
The ECNO analytical framework defines enablers as the underlying real-world or structural preconditions that support each building block in realising its objectives *en route* to climate neutrality. Enablers tend to function in one of three ways:

- (1) **removing** climate-damaging activities such as excessive fertiliser use (agrifood);
- (2) **shifting** attitudes, consumption patterns, or business practices like the uptake of zero emission and low carbon transport (mobility); or
- (3) **improving** existing systems, such as adopting robust institutional arrangements to ensure coherent policy-making (governance).

The assessment of progress for each building block towards its objectives and enablers is based on dedicated **indicators**. The selected indicators describe specific aspects of the objectives and enablers and provide a view on past changes in the context of the required future changes.

For this year's flagship report, the set of indicators has been expanded and updated to add further context and account for changes in data availability and political relevance. 28 new indicators were added and eight were replaced or removed (see Table 35). In general, the results for these new indicators validate the results of the first assessment, mostly providing further insights into the specific challenges.

**Figure 14: Selection of indicators based on building block objectives and enablers**



Source: ©ECNO based on previous work by Velten et al. (2021)

While data on headline indicators, such as GHG emissions or renewable energy shares, are readily accessible, limited and less regular, or continuous, information is collected for the structural changes that enable the transition. **A significant challenge to an assessment of detailed progress is therefore the availability of data.** In order not to restrict the selection of relevant indicators due to data limitations, the assessment also incorporates indicators that lack a comprehensive dataset. Where this limits the interpretation of results, the report highlights critical information gaps.

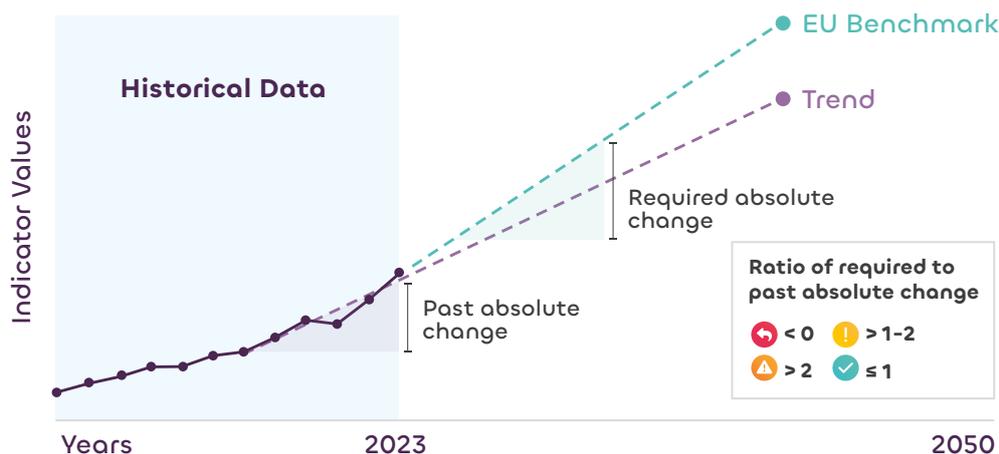
## 6.2 The progress check

ECNO checks past progress against **the EU's own vision of climate neutrality**, based on official EU targets and benchmarks from EU strategic planning documents. This includes EU Directives and Regulations as well as the underlying impact assessments of the EU 2030 Climate Target Plan and the EU long-term strategy (LTS).

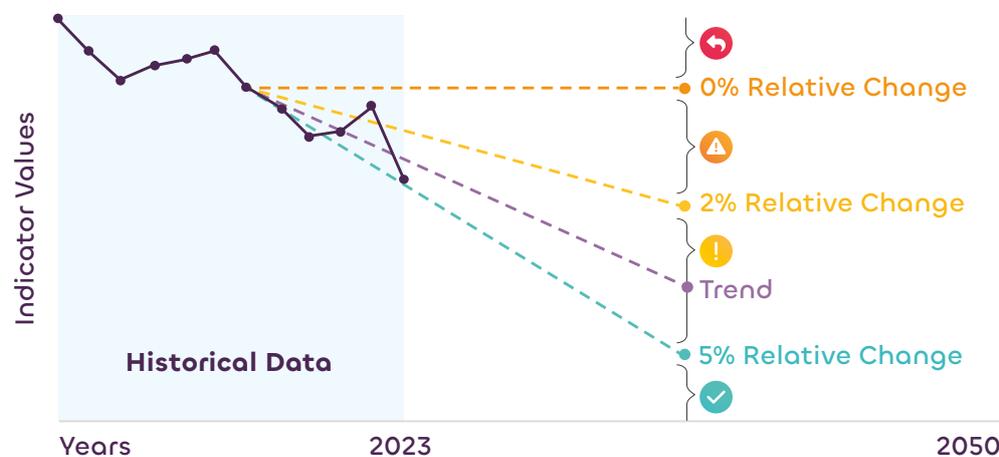
The **progress check compares the absolute annual change of the past development with the absolute required annual change** to meet the future benchmark, starting with the last data point of the trendline and drawing a straight line to the benchmark. The ratio between these two values (ratio of the slopes of the two lines) indicates the required change in the pace of development (a similar method is used by Schumer et al., 2022). If no quantified future benchmark can be derived from EU sources, the analysis relies on qualitative insights from official EU documents as well as on external scientific literature outlining the desired direction and speed of change (see Figure 15).

**Figure 15: Progress check for indicators with and without a benchmark**

Progress check for indicator with future benchmark



Progress check for indicator without future benchmark



Source: ©ECNO based on other monitoring activities (Eurostat, 2014; Schumer et al., 2022). Please note that classification for indicators without a benchmark can deviate from the given ranges to reflect on the characteristics of an indicator.

To ease the communication of results, **progress for each indicator is classified** along a five-degree scale: Four classes indicate the degree or lack of progress, namely ‘**on track**’, ‘**too slow**’, ‘**far too slow**’, and ‘**wrong direction**’; while the fifth class, ‘insufficient data’, is applied where no progress check can be carried out due to missing data.

**Table 35: Progress categories for indicators with and without benchmark**

Class	Description	Indicators with benchmark	Indicators without benchmark
	<b>Insufficient data</b> Data were insufficient to assess progress	/	/
	<b>Wrong direction</b> Change has been moving in the wrong direction; a U-turn is needed	Ratio of required to past absolute change is < 0	Past relative change is < 0%
	<b>Far too slow</b> Change has been moving in the right direction but well below the required pace	Ratio of required to past absolute change is > 2	Past relative change is ≥ 0% to < 2%
	<b>Too slow</b> Change has been moving in the right direction at a promising but insufficient pace	Ratio of required to past absolute change is > 1 to 2	Past relative change is ≥ 2% to < 5%
	<b>On track</b> Change has been moving at or above the required pace	Ratio of required to past absolute change is ≤ 1	Past relative change is ≥ 5%

Source: ©ECNO based on other monitoring activities (Eurostat, 2014; Schumer et al., 2022). Please note that classification for indicators without a benchmark can deviate from the given ranges to reflect on the characteristics of an indicator.

The same four-degree progress classification is used to describe the **overall progress for each climate neutrality building block**. Here the assessment is based on the progress of the underlying indicators and expert judgement informed by a nuanced reflection on the indicator values and their respective importance, as well as policy developments (similar to the approach taken by e.g., IEA, 2023). This is particularly important as historical data usually stop two to three years prior to 2024. In the meantime, relevant EU policy may have been adopted. While these policies will take time to take effect and be reflected in the data, they are still important to consider when classifying the building blocks. Thus, to bridge this time gap, we have analysed the EU policy context over the last five years for each objective and enabler, in addition to the quantitative past progress assessment of the historical data. This approach ensures a timely and comprehensive progress check.

For more detail on ECNO’s methodology, please refer to the [ECNO website](#) and the updated version of the [methodology paper](#).

## 6.3 Changes to the framework compared to the last year's report

The updating of the report required some changes to the framework and naming of objectives and enablers. Key changes include:

- Across all building blocks, the names of objectives and enablers, as well as of some indicators, have been simplified and streamlined to make them more accessible. Full details on each indicator can still be found on the website.
- For some indicators, there was a change of the source for historical data. This was the case when other data sources could provide more up-to-date data.
- In adaptation, there was a change in the selected enablers to reflect the different aspects of adaptation better. Now, enablers focus on adaptation action on the ground, governance, and finance.

More detail can be found in the following table:

**Table 36: Changes in the indicator framework compared to last year's report**

	Subject of change	Revision	Reasoning
Electricity	O	Indicator added: Share of gas fired power generation; Share of coal-fired power generation	Gas phase-out is particularly lagging, but there is no clear indicator available yet.
	E3	Indicator added: Electricity share in final energy demand	Electrification is progressing too slowly, and while the issue can best be addressed in other building blocks (buildings, industry, transport), it is still included here providing a central place of an overview; highlighting the importance to show sector coupling and hence demand side flexibility integration.
	E3	Indicator deleted: Battery storage and dispatchable renewable energy additions	Continued lack of data and unavailability of other proxy indicators.
	E3	Indicator added: Battery storage capacity [GW]	While the indicator does not cover the issue of energy storage fully, it can serve as a proxy until better data for energy storage becomes available.
	E3	Indicator added: Non- fossil participation in capacity markets (historical data and benchmark)	Another proxy indicator to get a better understanding of the flexibility available in electricity. Data were not yet available for last year's report.

	Subject of change	Revision	Reasoning
Mobility	E2	Name changed to 'Enable modal shift' from 'Shifting to public mobility'	The name was changed to reflect the need to shift both passenger and freight transport from road to rail and other less emissions-intensive modes of transport.
	E3	Indicator added: Share of ZEVs in new passenger car registrations	The indicator was added because the EU has, in effect, set a 100% ZEV target for 2035 via its revised CO <sub>2</sub> emission performance standards.
	E3	Indicator added: Total number of recharging points	The indicator was added because recharging infrastructure remains a key barrier to EV adoption.
Industry	E1	Indicator changed: 'CO <sub>2</sub> injection capacity' switched to 'amount of CO <sub>2</sub> captured'	This change reflects the preference with regards to the measure, which is considered more accurate in tracking the scale of deployment of carbon capture technologies; for now, there are no data available for any of the indicators.
Buildings	E1	Indicator added: Demand for heating of residential buildings	Data on the wide scope (all buildings) are old. More recent data have been found, but on a smaller scope (residential buildings).
	E2	Indicator disaggregated: Deep renovation rate split into residential and non-residential buildings	The renovation targets of the EU are differentiated for residential and non-residential buildings.
	E3	Indicator added: Heat pump sales	The EC took the initiative in 2023 with the EU Heat Pump Action Plan – a non-legislative initiative.
Agri-food	E3	Data source and name changed for 'Volume of food waste'	The data source was switched to an officially used source to reflect the EU target of halving food waste per capita by 2050.
Carbon Dioxide Removal	E1	Indicator changed: 'Growing tree stock [Mm <sup>3</sup> per year]' switched to 'Growth of carbon stock in living biomass in forest land [MtC per year]'	The former indicator (Forest Europe, 2020) has not been updated after 2020. The new indicator is also a useful indicator of forest size, health, and density of tree planting.
	E3	Indicator changed: 'DACCS and BECCS capacities [MtCO <sub>2</sub> e]' switched to 'Attention to technical CDR [tbd]'	The former indicator was very similar to the objective's indicator (net removals from technical removals). The new indicator serves as a placeholder for now.
Lifestyles	E1	Indicator change: 'Investment in public transport [EUR per capita]' switched to 'Investment in cycling infrastructure [EUR]'	There are data available for the former indicator. For the new indicator, the European Cycling Foundation's report on cycling infrastructure provides the latest data on investment in the EU funding period.
	E3	Indicator added: Sales trends of plant-based food items in EU [EUR billion]	Sales of plant-based food items indicate if choosing the meat alternative becomes the norm. There is a reliable source with recent data.

	Subject of change	Revision	Reasoning
Clean Technologies	E1	Indicator deleted: Number of R&D researchers deleted	The indicator is redundant.
	E1 / E2	Indicator shifted: 'Funds allocated to R&D' moves into enabler 1	The indicator fits better in enabler 1, as it concerns research.
	E2	Indicator added: Early stage cleantech investment	The indicator adds new insights partly substituting the 'private investment' indicator.
	E3	Indicator deleted: 'Private investment' (disaggregated into two other indicators)	Private investment in cleantech is a broad issue. The different focuses of the enablers benefit from a disaggregated approach.
	E3	Indicator added: cleantech scale up finance	The indicator adds new insights partly substituting the 'private investment' indicator.
	E3	Indicator added: Battery Manufacturing Capacity	The NZIA adds new targets for cleantech manufacturing. Targets were also added for other cleantech; however, in terms of size of industry and investment needs, batteries are by far the most consequential. Coverage could be expanded, or more technologies added, in a future version of this report.
Just and Inclusive Transition	O	Indicator scope changed: update of the list of regions covered	Now, the indicator is calculated not only for the EU regions that are considered carbon-intensive by the OECD, but also for all of the NUTS-2 regions that are covered by the JTF (given some discrepancies between assessments in literature and the actual JTF list).
	E1	Indicator added: employment rate in regions	The indicator serves as a proxy for the economic development of the regions in transition. It also helps to assess if transitioning regions provide sufficient employment opportunities for workers in all economic sectors, not only in the 'green' jobs sector.
	E1	Enabler renamed: 'Creating job opportunities' instead of 'Creating green jobs'	The change of the name reflects the wider scope of this enabler in this edition of the report, after the new indicator 'employment rate in regions' was added.
	E3	Enabler renamed: 'Supporting vulnerable groups with the right policy mix' instead of 'Targeted support to vulnerable groups'	The new name reflects the scope of the indicator better and allows for including more indicators in the future, relevant for tracking progress on just transition.
	E3	Indicator removed: 'Social Climate Fund's targeted support distributed to low-income households'	The indicator is not relevant at this point in time, as the Social Climate Fund is not yet operational; the indicator will be restored in a future edition of the progress assessment once the payments from the Fund become available.

	Subject of change	Revision	Reasoning
Governance	○	Indicator added: Thorough implementation of short-term EU governance standards at national level	This indicator tracks the timely and sufficiently detailed implementation of short-term monitoring and planning obligations under the EU Governance Regulation at the national level. This includes (1) national energy and climate plans (NECPs), (2) biennial progress reporting, and (3) PAMs/projections reporting. Note: no comprehensive time series data.
	○	Indicator added: EU cities committed under the Covenant of Mayors	This indicator tracks subnational political support for climate action by measuring the share of the EU population living in cities that are signatories to the Global Covenant of Mayors for Climate and Energy. This provides a more holistic picture of progress towards the objective of societal buy-in by measuring support from local and municipal governments (subnational perspective).
	○	Indicator added: Science-based climate neutrality targets in large EU companies (SBTi-validated)	This indicator tracks private sector support for climate action by measuring the number EU companies with 'clearly defined, science-based' net zero targets, which have been validated by the Science Based Targets initiative (SBTi) under its Corporate Net Zero Standard. This provides a more holistic picture of progress towards the objective by measuring support from large companies (private sector perspective).
Governance	E1 / E2	Enabler renamed and new structure	The enablers were restructured around themes of accountability and vision, consistency, and participation.
	E1 / E3	Indicators renamed: following the removal of EU-level data and use of the share of emissions: 'Up-to-date and compliant long-term strategies (LTS) at national level'; 'Independent scientific advisory bodies at national level'; 'Citizens' climate assemblies at national level'	Removing EU data allows for an assessment based on emissions, which keeps the approach consistent across indicators, focused on national-level institutions and processes
	E2	Indicator added: Green budgeting practices at national level	This indicator tracks the share of GHG emissions from EU Member States that have implemented some form of green budgeting at the national level. It serves as a proxy for climate mainstreaming at the national level.
	E2	Indicator added: Up-to-date strategic planning at EU level	This indicator tracks up-to-date sectoral and horizontal climate planning at the EU level across ECNO's building blocks for a climate neutral future. It serves as a proxy for climate mainstreaming at the EU level.

	Subject of change	Revision	Reasoning
Adaptation	E1	Three enablers from the previous report are now merged into a single enabler "Adaptation actions" representing on-the-ground adaptation measures in a range of areas; one indicator was kept from each of the previous three enablers where data exists to some degree	To capture a more holistic view on adaptation, it was decided to add enablers capturing elements of adaptation finance and governance. More details on these can be found below.
	E2	Indicator added: National adaptation policy in place [%]; Monitoring, reporting, evaluation in place or being developed [%]	New indicators have been added to show progress toward the new enabler on robust adaptation governance.
	E3	Indicator added: Financing adaptation; Total investment needs [bnEUR]; Total planned expenditure [bnEUR]; Actual spending [bnEUR]	New indicators have been added to show progress towards the new enabler on adaptation finance.

Source: ©ECNO. Note: O = objective, E1 = enabler 1, E2 = enabler 2, E3 = enabler 3.





# 7 References

## Literature references

- Abnett, K., & Wacket, M. (2024). EU countries back truck emissions law after German hold-up. Reuters.
- ACEA. (2021a). Electric cars: Lower-income countries fall behind, with uptake linked to GDP per capita. European Automobile Manufacturers' Association.
- ACEA. (2021b). Risk of two-track Europe for e-mobility with sharp divisions in roll-out of chargers, auto industry warns. European Automobile Manufacturers' Association.
- ACEA. (2022). Electric cars: Half of all chargers in EU concentrated in just two countries. European Automobile Manufacturers' Association.
- ACEA. (2023a). Electric Cars: Tax Benefits and Purchase Incentives. European Automobile Manufacturers' Association.
- ACEA. (2023b). Electric commercial vehicles: Tax benefits and purchase incentives. European Automobile Manufacturers' Association.
- ACEA. (2023c). Fact sheet: EU-China vehicle trade. European Automobile Manufacturers' Association.
- ACEA. (2023d). Interactive map – Affordability of electric cars: Correlation between market uptake and annual net income. European Automobile Manufacturers' Association.
- ACEA. (2023e). New data reveals that many Europeans struggle to afford electric cars. European Automobile Manufacturers' Association.
- ACER. (2022). Wholesale Electricity Market Monitoring 2022 – Key Developments. European Union Agency for the Cooperation of Energy Regulators.
- ACER. (2023a). Report on Investment Evaluation, Risk Assessment and Regulatory Incentives for Energy Network Projects. European Union Agency for the Cooperation of Energy Regulators.
- ACER. (2023b). Security of EU electricity supply. European Union Agency for the Cooperation of Energy Regulators.
- ADEME. (2021). Investissements d'avenir: Un levier puissant pour la R&D et l'innovation [ADEME]. Agence de la Transition Écologique.
- Al-Juaied, M., & Whitmore, A. (2023). Prospects for Direct Air Carbon Capture and Storage: Costs, Scale, and Funding | Belfer Center for Science and International Affairs. Belfer Center for Science and International Affairs.
- Arboleas, M. S. (2024). EU Commission backtracks on agricultural emissions cuts. Euractiv.
- Averchenkova, A., Fankhauser, S., & Finnegan, J. (2018). The role of independent bodies in climate Governance: The UK's Committee on Climate Change. Grantham Research Institute on Climate Change and the Environment, Centre for Climate Change Economics and Policy.
- Averchenkova, A., Higham, C., Chan, T., & Keuschnigg, I. (2024). Impacts of climate framework laws: Lessons from Germany, Ireland and New Zealand. Grantham Research Institute on Climate Change and the Environment; Centre for Climate Change Economics and Policy.
- Balafoutis, A., Beck, B., Fountas, S., Vangeyte, J., van der Wal, T., Soto, I., Gómez-Barbero, M., Barnes, A., & Eory, V. (2017). Precision Agriculture Technologies Positively Contributing to GHG Emissions Mitigation, Farm Productivity and Economics. *Sustainability*, 9(8).
- Bednar, J., Höglund, R., Möllersten, K., Obersteiner, M., & Tamme, E. (2023). The role of carbon dioxide removal in contributing to the long-term goal of the Paris Agreement. IVL Swedish Environmental Research Institute.
- Bellassen, V., Angers, D., Kowalczewski, T., & Olesen, A. (2022). Soil carbon is the blind spot of European national GHG inventories. *Nature Climate Change*, 12, 1–8.
- Berg Insight. (2022). Smart Metering in Europe. Berg Insight.
- Berg Insight. (2023). Smart electricity meter penetration rate in Europe reached 56 percent at the end of 2022. Berg Insight.
- Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, 12(3), 235–240.

- Bermel, L., Deese, B., Delgado, M., English, L., Garcia, Y., Hansmann, L., Houser, T., Stewart, N., & Tavarez, H. (2023). Clean Investment Monitor: Q3 2023 Update. Clean Investment Monitor.
- Bernal, B., Murray, L. T., & Pearson, T. R. H. (2018). Global carbon dioxide removal rates from forest landscape restoration activities. *Carbon Balance and Management*, 13(1), 22.
- Bernard, M. R., Hall, D., & Lutsey, N. (2021). Update on electric vehicle uptake in European cities. The International Council on Clean Transportation.
- Biedenkopf, K., & Petri, F. (2021). The European External Action Service and EU Climate Diplomacy: Coordinator and supporter in Brussels and beyond. *European Foreign Affairs Review*, 26(1), 71–86.
- Bielewski, M., Pfrang, A., Bobba, S., Kronenberga, A., Georgakaki, A., Letout, S., Kuokkanen, A., Mountraki, A., Ince, E., Shtjefni, D., Joanny Ordonez, G., Eulaerts, O., & Grabowska, M. (2022). Clean Energy Technology Observatory: Batteries for Energy Storage in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets. JRC.
- Björkbom, C. (2023). The EU sustainable food systems framework—Potential for climate action. *Npj Climate Action*, 2(4).
- Blot, E., & Kettunen, M. (2021). Trade policy review: How green is the future of EU trade?
- BMDV. (2021). Richtlinie über die Förderung von leichten und schweren Nutzfahrzeugen mit alternativen, klimaschonenden Antrieben und dazugehöriger Tank- und Ladeinfrastruktur. Bundesministerium für Digitales and Verkehr.
- BMDV. (2024). Das BMDV bringt die Elektromobilität in Deutschland voran. Bundesministerium für Digitales and Verkehr.
- BMEL. (2021a). Charter for Wood 2.0—Mitigating climate change. Creating value. Utilising resources efficiently. Bundesministerium für Ernährung und Landwirtschaft.
- BMEL. (2021b). Waldstrategie 2050. Bundesministerium für Ernährung und Landwirtschaft.
- BMEL. (2023a). Referentenentwurf—Entwurf eines Gesetzes zur Neuordnung des Bundeswaldgesetzes. Bundesministerium für Ernährung und Landwirtschaft.
- BMEL. (2023b). Förderprogramm klimaangepasstes Waldmanagement. Bundesministerium für Ernährung und Landwirtschaft.
- BMEL. (2024a). Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz. Bundesministerium für Ernährung und Landwirtschaft.
- BMEL. (2024b). Waldklimafonds. Bundesministerium für Ernährung und Landwirtschaft.
- BMUV. (2023). Aktionsprogramm Natürlicher Klimaschutz. Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz.
- BMWK. (2024). Langfriststrategie Negativemissionen zum Umgang mit unvermeidbaren Restemissionen (LNe). Bundesministerium für Wirtschaft und Klimaschutz.
- Boehlje, M. (2021). The Value Of Data/Information And The Payoff Of Precision Farming. Purdue University Center for Commercial Agriculture.
- Bongrovi, F., Lanzi, E., Seitz, H., Bibas, R., Foure, J., Hubert, P., & Atarody, L. (2023). The effects of the EU Fit for 55 package on labour markets and the demand for skills.
- Borghesi, S., Pahle, M., Perino, G., Quemin, S., & Willner, M. (2023). The Market Stability Reserve in the EU Emissions Trading System: A Critical Review. *Annu. Rev. Resour. Econ.*, 15, 131–152.
- BPIE. (2021). Deep Renovation: Shifting from exception to standard practice in EU Policy > BPIE - Buildings Performance Institute Europe. Buildings Performance Institute Europe.
- BPIE. (2022). Roadmap to climate-proof buildings and construction – How to embed whole-life carbon in the EPBD. Buildings Performance Institute Europe.
- BPIE. (2023a). EU Buildings Climate Tracker: A call for faster and bolder action. Buildings Performance Institute Europe.
- BPIE. (2023b). Minimum standards, maximum impact: How to design fair and effective minimum energy performance standards. Buildings Performance Institute Europe.
- Brook, L. (2022). Organic Agriculture Helps Solve Climate Change. National Resources Defense Council.
- Bruegel. (2023). National fiscal policy responses to the energy crisis. Bruegel.
- Buckwell, A., & Nadeu, E. (2018). What is the Safe Operating Space for EU livestock? RISE Foundation.
- Cacho, O. J., Wise, R. M., & MacDicken, K. G. (2004). Carbon Monitoring Costs and their Effect on Incentives to Sequester Carbon through Forestry. *Mitigation and Adaptation Strategies for Global Change*, 9(3), 273–293.
- Calipel, C., Bizien, A., & Pellerin-Carlin, T. (2024). European Climate Investment Deficit report: An investment pathway for Europe’s future. Institute for Climate Economics.
- CAN-E. (2023). Time to step up national climate action: An assessment of the draft National Energy and Climate Plans updates. Climate Action Network Europe.

- Canopée. (2023). Canopée publie le bilan caché du plan de relance en forêt. Canopée.
- Carbon Gap. (2022). Public Consultation on the new EU Framework for Forest Monitoring and Strategic Plans. Carbon Gap.
- Carbon Gap. (2023a). Carbon Removal in the EU Common Agricultural Policy. Carbon Gap.
- Carbon Gap. (2023b). The low-carbon label. Carbon Gap.
- Carbon Gap. (2023c). Mapping CDR funding – Where is carbon removal in Horizon Europe? Carbon Gap.
- Carbon Gap. (2024a). Carbon Removal in the EU Innovation Fund. Carbon Gap.
- Carbon Gap. (2024b). Country Data Summary. Carbon Gap.
- Carbon Gap. (2024c). Envisioning a carbon removal strategy for Europe. Carbon Gap.
- Carey, N., Guillaume, G., & White, J. (2024). European, US carmakers race to lower EVs costs as China competition heats up. Reuters.
- Casert, R. (2024). As the rumble of tractor protests grows, the EU offers more environmental concessions to farmers. AP News.
- CAT. (2024). EU Country Summary. Climate Action Tracker.
- CATF. (2024). Global Carbon Capture Project Map. Clean Air Task Force.
- CEDEFOP. (2021). The green employment and skills transformation: Insights from a European Green Deal skills forecast scenario. European Centre for the Development of Vocational Training.
- CEPS. (2023). Jobs for the Green Transition. Centre for European Policy Studies.
- Chancel, L. (2022). Global carbon inequality over 1990–2019. *Nature Sustainability*, 5(11), 931–938.
- CJEU. (2017). Purely plant-based products cannot, in principle, be marketed with designations such as ‘milk’, ‘cream’, ‘butter’, ‘cheese’ or ‘yoghurt’, which are reserved by EU law for animal products. Court of Justice of the European Union.
- Clark, D. (2024). Shift Funding From Animal Agriculture, Says EU Science Board. *Plant Based News*.
- Clausen, U., & Voll, R. (2013). A comparison of North American and European railway systems: Why Europe needs particular optimization models for railway freight traffic. *European Transport Research Review*, 5(3), 129–133.
- Cleantech for Europe. (2024). Cleantech for Europe Proprietary Dataset [dataset]. Cleantech for Europe.
- ClientEarth. (2018). Info-brief: EUTR enforcement in Romania. ClientEarth.
- Climate Home News. (2023). OECD: Rich countries ‘likely’ to hit \$100bn climate finance goal in 2022. Climate Home News.
- Collins, L. (2021). Green hydrogen is too expensive—These 38 government policies are needed to make it viable. *Recharge*.
- Colthorpe, A. (2022). Europe needs a ‘massive rollout’ of energy storage. *Energy Storage News*.
- CONEBI. (2021). 2021 European Bicycle Industry and Market Profile [Market Profile]. Confederation of the European Bicycle Industry.
- Covenant of Mayors. (2023). Our cities database [dataset]. Covenant of Mayors.
- Danielis, R. (2023). Fiscal Policies on New Passenger Cars in Europe: Implications for the Competitiveness of Electric Cars. *Sustainability*, 15(23).
- Delta-EE. (2022). Can Europe meet 2030 REPowerEU targets without energy storage? *Delta Energy & Environment*.
- Demertzis, M. (2023). Capital Markets Union, or else what? *Bruegel*.
- DESNZ. (2023). Clean Heat Market Mechanism. Department for Energy Security and Net Zero.
- Detzel, A., Krüger, M., Busch, M., Blanco-Gutiérrez, I., Varela, C., Manners, R., Bez, J., & Zannini, E. (2021). Life cycle assessment of animal-based foods and plant-based protein-rich alternatives: An environmental perspective. *Journal of the Science of Food and Agriculture*, 102(12).
- Detzner, F., Loewenbourg-Brezekinski, E., Schmid, C., Gehring, C., & Suchy, O. (2023). Shaping the future is hard: Fostering sustainable transformation by improving access to finance for hardware-based climate tech startups. *Sustainable Finance Beirut*.
- DG AGRI. (2023). EU-27 estimated agricultural balance sheets. European Commission.
- DG Energy, IPSOS, & Navigant. (2019). Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU: Final report. Publications Office of the European Union.
- DGAL. (2024). Renouveau forestier: La Commission européenne valide le régime français d’aides à la prévention et à la réparation des dommages causés aux forêts. Ministère de l’Agriculture et de la Souveraineté alimentaire.

- Didi, R., Mascolo, F., & Laugier, R. (2023). Public participation in national energy and climate plans: Evidence of weak and uneven compliance in Member States. Together For 1.5 Project Report (Together For 1.5). CAN Europe, WWF EPO.
- Direction Générale du Trésor. (2023). Annexe au projet de loi de finances pour 2024, Rapport économique, social et financier. Perspectives économiques et des finances publiques. Direction Générale du Trésor.
- Donor Tracker. (2023). Issue Deep Dive: EUI/Climate. SEEK Development.
- Dubash, N. K., Pillai, A. V., Flachsland, C., Harrison, K., Hochstetler, K., Lockwood, M., MacNeil, R., Mildemberger, M., Paterson, M., Teng, F., & Tyler, E. (2021). National climate institutions complement targets and policies. *Science*, 374(6568), 690–693.
- Duwe, M. (2022). Making EU Climate Governance Fit for Net Zero. Ecologic Institute.
- Duwe, M., & Evans, N. (2020). Climate Laws in Europe: Good Practices in Net-Zero Management. Ecologic Institute; European Climate Foundation.
- Duwe, M., Graichen, J., & Böttcher, H. (2022). Can current EU climate policy reliably achieve climate neutrality by 2050? Post-2030 crunch issues for the move to a net zero economy. Ecologic Institute.
- Duwe, M., Velten, E. K., Evans, N., Freundt, M., Pestiaux, J., Martin, B., & Vermeulen, P. (2019). Planning for net-zero: Assessing the Draft National Energy and Climate Plans. Ecologic Institute; Climact; European Climate Foundation.
- EAFO. (2024a). European Alternative Fuels Observatory—Road—Individual countries. European Alternative Fuels Observatory.
- EAFO. (2024b). European Union (EU27)—Country Comparison. European Commission.
- EC. (2011). Analysis associated with the Roadmap to a Resource Efficient Europe Part II. SEC(2011) 1067 final. European Commission.
- EC. (2018). In-depth analysis in support on the COM(2018) 773: A Clean Planet for all—A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. European Commission.
- EC. (2019). The European Green Deal. European Commission.
- EC. (2020a). 2030 Climate Target Plan Impact Assessment. European Commission.
- EC. (2020b). A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. European Commission.
- EC. (2020c). A hydrogen strategy for a climate-neutral Europe. European Commission.
- EC. (2020d). A Renovation Wave for Europe—Greening our buildings, creating jobs, improving lives. European Commission.
- EC. (2020e). Benchmarking smart metering deployment in the EU-28: Final report. In Publications Office (Issue December). European Commission.
- EC. (2020f). Circular economy action plan: For a cleaner and more competitive Europe. European Commission.
- EC. (2020g). Commission Staff Working Document Impact Assessment Accompanying the document Communication from the Commission to the European Parliament, the Council, and the European Economic and Social Committee and the Committee of the Regions Stepping up Europe's 2030 climate ambition Investing in a climate-neutral future for the benefit of our people. European Commission.
- EC. (2020h). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A new Circular Economy Action Plan For a cleaner and more competitive Europe. European Commission.
- EC. (2020i). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (European Climate Pact) COM(2020) 788 Final. European Commission.
- EC. (2020j). European Skills Agenda for sustainable competitiveness, social fairness and resilience. European Commission.
- EC. (2020k). Impact Assessment. Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people. European Commission.
- EC. (2020l). Proposal for a Regulation of the European Parliament and of the Council Establishing the Just Transition Fund. European Commission.
- EC. (2021a). Commission Recommendation for Effective Active Support to Employment (EASE). European Commission.
- EC. (2021b). Commission Staff Working Document Impact Assessment Accompanying the Proposal for a Regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council. European Commission.
- EC. (2021c). Communication from the Commission to the European Parliament, the Council, and the European Economic and Social Committee and the Committee of the Regions “Fit for 55”: Delivering the EU's 2030 Climate Target on the way to climate neutrality. European Commission.

- EC. (2021d). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Strategy for Financing the Transition to a Sustainable Economy (COM/2021/390 final). European Commission.
- EC. (2021e). EU Code of Conduct for Responsible Food Business and Marketing Practices—A common aspirational path towards sustainable food systems. European Commission.
- EC. (2021f). Forging a climate-resilient Europe—The new EU Strategy on Adaptation to Climate Change. COM(2021) 82. European Commission.
- EC. (2021g). New EU Forest Strategy for 2030. European Commission.
- EC. (2021h). Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity (recast). European Commission.
- EC. (2021i). Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast) COM/2021/802 final. European Commission.
- EC. (2021j). Proposal for a Regulation of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network, amending Regulation (EU) 2021/1153 and Regulation (EU) No 913/2010 and repealing Regulation (EU) 1315/2013. European Commission.
- EC. (2021k). Questions and Answers: An open, sustainable and assertive trade policy. European Commission.
- EC. (2021l). Revision of the Energy Taxation Directive. European Commission.
- EC. (2021m). Sustainable and Smart Mobility Strategy. European Commission.
- EC. (2021n). The Common Agricultural Policy: 2023-27. European Commission.
- EC. (2021o). The European Pillar of Social Rights Action Plan. European Commission.
- EC. (2021p). Commission Staff Working Document: Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem. European Commission.
- EC. (2021q). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The New EU Urban Mobility Framework. European Commission.
- EC. (2021r). Communication from the Commission to the European Parliament and the Council: Sustainable Carbon Cycles. European Commission.
- EC. (2022a). Commission Recommendation on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements. European Commission.
- EC. (2022b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Environmental Implementation Review Turning the tide through environmental compliance (COM/2022/438 final). European Commission.
- EC. (2022c). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The power of trade partnerships: Together for green and just economic growth. European Commission.
- EC. (2022d). Digitalising the energy system—EU action plan. In SWD(2022) 341 final. European Commission.
- EC. (2022e). European Union Green Budgeting Reference Framework. European Commission.
- EC. (2022f). Implementing the Repower EU action plan: Investment needs, hydrogen accelerator and achieving the bio-methane targets accompanying the document communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions REpowerEU Plan. European Commission.
- EC. (2022g). Innovation fund progress report: Report from the Commission to the European Parliament and the Council, August 2022. Publications Office of the European Union.
- EC. (2022h). Proposal for a council regulation on an emergency intervention to address high energy prices. European Commission.
- EC. (2022i). Proposal for a regulation of the European Parliament and of the council establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products. European Commission.
- EC. (2022j). Proposal for a Regulation of the European Parliament and of the Council on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC. European Commission.
- EC. (2022k). Proposal for a Revision of the Industrial Emissions Directive. European Commission.
- EC. (2022l). REPowerEU Plan. European Commission.
- EC. (2022m). Study on energy subsidies and other government interventions in the European Union – Final report – 2022 edition. European Commission, Directorate-General for Energy.
- EC. (2022n). The power of trade partnerships: Together for green and just economic growth. European Commission.

- EC. (2022o). Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC. European Commission.
- EC. (2023a). 2023 Report on Energy Subsidies in the EU. European Commission.
- EC. (2023b). CO<sub>2</sub> emission performance standards for cars and vans. European Commission.
- EC. (2023c). Commission guidelines for defining, mapping, monitoring and strictly protecting EU primary and old-growth forests. European Commission.
- EC. (2023d). Commission staff working document. Assessment of progress towards the objectives of the Energy Union and Climate Action Accompanying the document Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions State of the Energy Union 2023 Report (pursuant to Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action). SWD(2023) 646 final. (SWD(2023) 646 final). European Commission.
- EC. (2023e). Commission Staff Working Document for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act). European Commission.
- EC. (2023f). Communication from the Commission to the European Parliament, the Council, and the European Economic and Social Committee and the Committee of the Regions Proposing a European Declaration on Cycling. European Commission.
- EC. (2023g). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU wide assessment of the draft updated National Energy and Climate Plans An important step towards the more ambitious 2030 energy and climate objectives under the European Green Deal and RePowerEU (COM/2023/796 final). European Commission.
- EC. (2023h). Denmark—Draft Updated NECP 2021-2030. European Commission.
- EC. (2023i). Eco-Innovation Scoreboard. European Commission.
- EC. (2023j). Electricity Market Design revision: Proposal to amend the Electricity Market Design rules. European Commission.
- EC. (2023k). ETS Market Stability Reserve to reduce auction volume by over 272 million allowances between September 2023 and August 2024. European Commission.
- EC. (2023l). EU Building Stock Observatory [dataset]. European Commission.
- EC. (2023m). EU Climate Action Progress Report 2023 (COM(2023) 653 final). European Commission.
- EC. (2023n). EUR-Lex [dataset]. European Commission.
- EC. (2023o). European Wind power action plan. European Commission.
- EC. (2023p). France—Draft Updated NECP 2021-2030. European Commission.
- EC. (2023q). Germany—Draft Updated NECP 2021-2030. European Commission.
- EC. (2023r). Green budgeting in the EU: Key insights from the 2023 European Commission survey of green budgeting practices. European Commission.
- EC. (2023s). Green Deal: New guidelines for sustainable forest management and payment schemes for forest ecosystem services. European Commission.
- EC. (2023t). Grids, the missing link—An EU Action Plan for Grids. European Commission.
- EC. (2023u). Guidelines on Biodiversity-Friendly Afforestation, Reforestation and Tree Planting—European Commission. European Commission.
- EC. (2023v). Guidelines on Member States' adaptation strategies and plans. European Commission.
- EC. (2023w). Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity. European Commission.
- EC. (2023x). Monitoring to improve resilience of European forests. European Commission.
- EC. (2023y). National long-term strategies [dataset]. European Commission.
- EC. (2023z). Organic farming in the EU: a decade of growth. European Commission.
- EC. (2023aa). Proposal for a Directive of the European Parliament and of the Council amending Council Directive 92/106/EEC as regards a support framework for intermodal transport of goods and Regulation (EU) 2020/1056 of the European Parliament and the Council as regards calculation of external costs savings and generation of aggregated data. European Commission.
- EC. (2023ab). Proposal for a Directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste. European Commission.

- EC. (2023ac). Proposal for a Directive of the European Parliament and of the Council on common rules promoting the repair of goods and amending Regulation (EU) 2017/2394, Directives (EU) 2019/771 and (EU) 2020/1828. European Commission.
- EC. (2023ad). Proposal for a Directive on Soil Monitoring and Resilience. European Commission.
- EC. (2023ae). Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/1242 as regards strengthening the CO<sub>2</sub> emission performance standards for new heavy-duty vehicles and integrating reporting obligations, and repealing Regulation (EU) 2018/956. European Commission.
- EC. (2023af). Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design. European Commission.
- EC. (2023ag). Proposal for a Regulation of the European Parliament and of the Council on a monitoring framework for resilient European forests. European Commission.
- EC. (2023ah). Proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act). European Commission.
- EC. (2023ai). Proposal for a Regulation of the European Parliament and of the Council on the use of railway infrastructure capacity in the single European railway area, amending Directive 2012/34/EU and repealing Regulation (EU) No 913/2010). European Commission.
- EC. (2023aj). Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2019/631 as regards strengthening the CO<sub>2</sub> emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition. European Commission.
- EC. (2023ak). Report on Energy Subsidies in the EU. European Commission.
- EC. (2023al). Staff working Document—Energy Storage—Underpinning a decarbonised and secure EU energy system. European Commission.
- EC. (2023am). State of the EU Energy Union 2023, On the road to climate neutrality. European Commission.
- EC. (2023an). Study on energy subsidies and other government interventions in the European Union – 2023 edition. European Commission.
- EC. (2023ao). Summary of CAP Strategic Plans for 2023–2027: Joint effort and collective ambition. European Commission.
- EC. (2023ap). SWD(2023) 68 final, Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity. European Commission.
- EC. (2023aq). Trade and Climate: EU and partner countries launch the “Coalition of Trade Ministers on Climate.” European Commission.
- EC. (2023ar). The Green Deal Industrial Plan: Putting Europe's net-zero industry in the lead. European Commission.
- EC. (2023as). Consolidated text: Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. European Commission.
- EC. (2024a). Cohesion open data platform. European Commission.
- EC. (2024b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. European Commission.
- EC. (2024c). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Towards an ambitious Industrial Carbon Management for the EU. European Commission.
- EC. (2024d). Competence Centre on Behavioural Insights. European Commission.
- EC. (2024e). EU leaders call for strengthening the EU's competitiveness—European Commission. European Commission.
- EC. (2024f). Horizon Europe—Performance. European Commission.
- EC. (2024g). Innovation procurement. European Commission.
- EC. (2024h). Recovery and Resilience Scoreboard. European Commission.
- EC. (2024i). SETIS - SET Plan Information System: SETIS research and innovation data. European Commission.
- EC. (2024j). Staff working document—Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. European Commission.
- EC. (2024k). Towards a skills revolution: Results of the European Year of Skills. European Commission.
- EC. (2024l). Horizon 2020 evaluation shows that investment in EU research and innovation greatly pays off. European Commission.

- EC. (2024m). Impact Assessment Report: Securing our future, Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society. European Commission.
- EC. (2024n). Eco-schemes. European Commission.
- EC. (2024o). Renewable energy for heating & cooling up to 25% in 2022. European Commission.
- EC. (2024p). EU Heat Pump Action Plan. European Commission.
- EC. (2024q). Impact Assessment accompanying the document 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.
- ECA. (2021). Common Agricultural Policy and climate—Half of EU climate spending but farm emissions are not decreasing (16). European Court of Auditors.
- ECNO. (2023). State of EU Progress to Climate Neutrality: An indicator-based assessment across 13 building blocks for a climate neutral future (E. K. Velten, C. Calipel, M. Duwe, N. Evans, C. Felthöfer, M. Hagemann, J. Hecke, L. Kahlen, S. Lalieu, H. McDonald, N. Pelekh, T. Pellerin-Carlin, J. Pestiaux, K. Ramotowski, P. Schöberlein, H. Schritt, A. Śniegocki, A. Stefańczyk, & J. Tarpey, Eds.). European Climate Neutrality Observatory (ECNO).
- ECNO. (2024a). Briefing: Next steps in setting up EU progress monitoring for climate neutrality—A review of the European Commission's assessment of progress towards climate neutrality (E. K. Velten, M. Duwe, M. Hagemann, S. Jackson, & P. Schöberlein, Eds.). European Climate Neutrality Observatory (ECNO).
- ECNO. (2024b). Net zero risk in European climate planning: A snapshot of the transparency and internal consistency of Member States' NECPs (Y. Deng, S. Lalieu, J. Pestiaux, M. Hagemann, S. Jackson, A. Lefebvre, A. Śniegocki, A. Stefańczyk, & E. K. Velten, Eds.). European Climate Neutrality Observatory (ECNO).
- Ecologic Institute. (2024). Climate Framework Laws Info-Matrix. Version 240514 (N. Evans, M. Duwe, & D. Kocher, Eds.). Ecologic Institute.
- EEA. (2022a). Decarbonising road transport—The role of vehicles, fuels and transport demand (2/2022). European Environment Agency.
- EEA. (2022b). Percentage of total green infrastructure, urban green space, and urban tree cover in the area of EEA-38 capital cities (excluding Liechtenstein) [Data Visualization]. European Environment Agency.
- EEA. (2022c). Transforming Europe's food system—Assessing the EU policy mix. European Environmental Agency.
- EEA. (2023a). Economic losses from weather- and climate-related extremes in Europe. European Environment Agency.
- EEA. (2023b). EEA greenhouse gases—Data viewer on greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism (EU Member States). European Environment Agency.
- EEA. (2023c). Europe's material footprint. European Environment Agency.
- EEA. (2023d). Is Europe on track towards climate resilience? Status of reported national adaptation actions in 2023. European Environment Agency.
- EEA. (2023e). Monitoring, reporting and evaluation activities reported in 2023. European Environment Agency.
- EEA. (2023f). New registrations of electric vehicles in Europe. European Environment Agency.
- EEA. (2023g). Share of environmental taxes in total tax revenues. European Environment Agency.
- EEA. (2023h). Soil carbon. European Environment Agency.
- EEA. (2024a). European Climate Risk Assessment. European Environment Agency.
- EEA. (2024b). National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism (DAT-13-en). European Environment Agency.
- EEA, & ACER. (2023). Flexibility solutions to support a decarbonised and secure EU electricity system. European Environment Agency and Agency for the Cooperation of Energy Regulators.
- EEB. (2022). Citizenwashing: What it is and how to spot it. European Environmental Bureau.
- EEB. (2023a). NECP reporting: The missing voice of the public. European Environmental Bureau.
- EEB. (2023b). Public participation and the updating of NECPs: Towards more meaningful dialogue and deliberation. European Environmental Bureau.
- EHPA. (2024). Heat pump sales fall by 5% while EU delays action. European Heat Pump Association.
- EIB. (2019). EIB Group's Climate Bank Roadmap. European Investment Bank.
- EIB. (2024). Investment Report 2023/2024. European Investment Bank.
- Eickhout, B. (2024). Review of the CO2 emission standards for heavy-duty vehicles. European Parliament.
- Elderson, F. (2024). "Failing to plan is planning to fail" – why transition planning is essential for banks. European Central Bank.

- Ellerbeck, S. (2023). Owning an electric vehicle in Europe could be cheaper than you think, new research shows. World Economic Forum.
- Elomina, J., & Pülzl, H. (2021). How are forests framed? An analysis of EU forest policy. *Forest Policy and Economics*, 127, 102448.
- Ember. (2024a). Carbon Price Tracker [dataset]. Ember.
- Ember. (2024b). European Electricity Review. Ember.
- Energy Cities. (2020). National energy and climate plans: Is the key role of local authorities acknowledged? *Energy Cities*.
- ENTSO-E; ENTSOG. (2023). TYNDP 2024—Scenarios Storyline Report. European Network of Transmission System Operators for Electricity and European Network of Transmission System Operators for Gas.
- EP. (2023a). Report on job creation – the just transition and impact investments. European Parliament.
- EP. (2023b). COP28: MEPs want to end all subsidies for fossil fuel globally by 2025. European Parliament.
- EP. (2023c). Resolution on developing an EU cycling strategy. European Parliament.
- EP. (2023d). Deal on new guidelines for trans-European transport projects. European Parliament.
- EPRS. (2022). The future of the EU’s rural areas. European Parliamentary Research Service.
- EPRS. (2024). EU ‘farm to fork’ strategy: State of play. European Parliamentary Research Service.
- EREA. (2023). EU to co-fund 68 new campaigns to promote sustainable and high-quality EU farm products. European Research Executive Agency.
- ESABCC. (2023). Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030–2050. European Science Advisory Board on Climate Change.
- ESABCC. (2024). Towards EU climate neutrality. Progress, policy gaps and opportunities. European Science Advisory Board on Climate Change.
- EU CRF. (2023). European Union. 2023 Common Reporting Format (CRF) Table. [dataset]. European Union Common Reporting Framework.
- EUCO. (2018). Climate Diplomacy: Council adopts conclusions. Council of the European Union.
- EUCO. (2024a). Europe’s contribution to climate finance (€bn). Council of the European Union.
- EUCO. (2024b). EU strategic agenda 2024–2029. Council of the European Union.
- EUKI. (2019). Factsheet: Bonus-Malus Vehicle Incentive System (France). European Climate Initiative.
- Eurobarometer. (2023a). Climate change—July 2023— Eurobarometer survey. Eurobarometer.
- Eurobarometer. (2023b). Special Eurobarometer 538—Climate change. Eurobarometer.
- EurObserv’ER. (2023). The State Of Renewable Energies In Europe. EurObserv’ER.
- EurObserv’ER. (2024). Employment & Turnover. Employment (Direct and indirect jobs). EurObserv’ER.
- European Vegetarian Union. (2023). Plant-based Sustainable Public Procurement: Best Practices report. European Vegetarian Union.
- Eurostat. (2014). Getting messages across using indicators—A handbook based on experiences from assessing Sustainable Development Indicators. Eurostat.
- Eurostat. (2019). The EU’s population projected up to 2100. Eurostat.
- Eurostat. (2020). Agricultural practices. Eurostat.
- Eurostat. (2021). Land cover statistics. Eurostat.
- Eurostat. (2023a). Environmental goods and services sector (env\_egs). Eurostat.
- Eurostat. (2023b). Food waste and food waste prevention by NACE Rev. 2 activity—Tonnes of fresh mass. Eurostat.
- Eurostat. (2023c). Goods transport by road. Eurostat.
- Eurostat. (2023d). Greenhouse gas emission statistics—Carbon footprints. Eurostat.
- Eurostat. (2023e). Modal split of air, sea and inland freight transport. Eurostat.
- Eurostat. (2023f). Modal split of air, sea and inland passenger transport. Eurostat.
- Eurostat. (2023g). Population as a percentage of EU27 (from 2020) population [dataset]. Eurostat.
- Eurostat. (2023h). Population covered by the Covenant of Mayors for Climate & Energy signatories (sdg\_13\_60). Eurostat.
- Eurostat. (2023i). Heating and cooling from renewables gradually increasing. Eurostat.

- Eurostat. (2023j). Sold production, exports and imports. Eurostat.
- Eurostat. (2024a). Arrears on utility bills—EU-SILC survey. Eurostat.
- Eurostat. (2024b). Circular material use rate. Eurostat.
- Eurostat. (2024c). Complete energy balances. Eurostat.
- Eurostat. (2024d). Employment by sex, age, economic activity and NUTS 2 regions. Eurostat.
- Eurostat. (2024e). Employment in the environmental goods and services sector. Eurostat.
- Eurostat. (2024f). Employment rates by sex, age, educational attainment level, citizenship and NUTS 2 regions. Eurostat.
- Eurostat. (2024g). Government budget allocations for R&D (GBARD). Eurostat.
- Eurostat. (2024h). Gross domestic product at market prices [dataset]. Eurostat.
- Eurostat. (2024i). Inability to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day—EU-SILC survey. Eurostat.
- Eurostat. (2024j). Inability to afford paying for one week annual holiday away from home—EU-SILC survey. Eurostat.
- Eurostat. (2024k). Inability to keep home adequately warm—EU-SILC survey. Eurostat.
- Eurostat. (2024l). National accounts aggregates by industry (up to NACE A\*64). Eurostat.
- Eurostat. (2024m). Passenger cars—Per thousand inhabitants. Eurostat.
- Eurostat. (2024n). People at risk of poverty or social exclusion by NUTS 2 regions. Eurostat.
- Eurostat. (2024o). Population on 1 January by age group, sex and NUTS 2 region. Eurostat.
- Eurostat. (2024p). Resource productivity. Eurostat.
- Eurostat. (2024q). Share of fuels in final energy consumption. Eurostat.
- Eurostat. (2024r). GDP and main components (output, expenditure and income). Eurostat.
- Eurostat. (2024s). Carbon footprints (FIGARO application). Eurostat.
- Eurostat. (2024t). Material footprints—Main indicators. Eurostat.
- Eurostat. (2024u). Environmental tax revenues. Eurostat.
- EUUMO. (2023). Bridging urban-rural transport divides. EU Urban Mobility Observatory.
- Evans, N., & Duwe, M. (2021). Climate governance systems in Europe: The role of national advisory bodies. Ecologic Institute, IDDRI.
- Evans, N., Duwe, M., & Velten, E. K. (2023). Policy consistency: What it means, how to measure it, and links with other processes. Ecologic Institute, Berlin. Ecologic Institute.
- Evans, N., Schöberlein, P., & Duwe, M. (2024). Raising the bar on national climate governance in the EU. Ecologic Institute.
- Faber, R., Kocher, D., & Duwe, M. (2024). Fostering transformative climate governance? The potential of multilevel climate and energy dialogues. A criteria-based assessment of Member States' reports under Article 11 of the Governance Regulation. Ecologic Institute.
- FAO. (2023). Emissions totals [dataset]. Food and Agriculture Organization of the United Nations.
- FAO. (2024). FAOSTAT - Land Use. Food and Agriculture Organization of the United Nations.
- FE. (2022). Forecast of food, farming & fertilizer use in the European Union 2022-2032. Fertilizers Europe.
- FiBL. (2024). Europe Key Indicators [dataset]. Forschungsinstitut für biologischen Landbau.
- Fisher, S. D., Kenny, J., Poortinga, W., Böhm, G., & Steg, L. (2022). The politicisation of climate change attitudes in Europe. *Electoral Studies*, 79, 102499.
- Fleurence, L., Fetet, M., & Postic, S. (2023). Global carbon accounts in 2023. Institute for Climate Economics.
- Forest Europe. (2020). Forest Europe | State of Europe's Forests 2020. Forest Europe.
- Fossil Free EIB. (2022). EIB Backtracks on Path to Becoming Climate Bank. Fossil Free EIB.
- Fuss, S., Lamb, W. F., Callaghan, M. W., Hilaire, J., Creutzig, F., Amann, T., Beringer, T., De Oliveira Garcia, W., Hartmann, J., Khanna, T., Luderer, G., Nemet, G. F., Rogelj, J., Smith, P., Vicente, J. L. V., Wilcox, J., Del Mar Zamora Dominguez, M., & Minx, J. C. (2018). Negative emissions—Part 2: Costs, potentials and side effects. *Environmental Research Letters*, 13(6), 063002.
- Gerstenberg, K. (2023). ProVeg-Preisstudie 2023: Aufpreis für pflanzliche Alternativen deutlich gesunken. ProVeg.
- Good Food Institute. (2022). Europe plant-based food retail market insights. Good Food Institute.

- Green Central Banking. (2024). EU's corporate due diligence rule hits political roadblock. Green Central Banking.
- GRI. (2023). Climate change laws of the world database [dataset]. Grantham Research Institute.
- GridX. (2023). EV Charging Report 2023. GridX.
- Haahr, T. (2024). Reducing pollution from industry and large livestock farms. European Parliament.
- Harper, J. (2022). Polish subsidies boost electric cars. Deutsche Welle.
- Höllner, H. (2023). Neues Bundeswaldgesetz: Das plant Cem Özdemir für die Waldbesitzer | Forstpraxis. Forst Praxis.
- Hu, K., Chopra, S., & Chen, Y. (2021). The Effect of Tightening Standards on Automakers' Non-compliance. *Production and Operations Management*, 30(9). Sage Journals.
- Humphreys, C. (2023a). Taking a first step towards a cleantech investment plan [I4CE Online]. Institute for Climate Economics.
- Humphreys, C. (2023b). The sharpest tool in the box: How to strengthen the EU Innovation Fund for climate, competitiveness and security. Institute for Climate Economics.
- Hyrynen, M., Ollikainen, M., & Seppälä, J. (2023). European forest sinks and climate targets: Past trends, main drivers, and future forecasts. *European Journal of Forest Research*, 142(5), 1207–1224. ICCT. (2024). Passenger Vehicle Greenhouse Gas Emissions and Fuel Consumption. Passenger car emissions and consumption, normalized to WLTP. The International Council on Clean Transport.
- I4CE. (2024). Prudential transition plans: What's next after the adoption of the Capital Requirements Directive? Institute for Climate Economics.
- IDOS & Université Laval. (2018). Trade & Environment Database—TREND Analytics. German Institute of Development and Sustainability.
- IEA. (2018). Nordic region offers valuable lessons for rapid EV deployment worldwide. International Energy Agency.
- IEA. (2021a). Global EV Outlook 2021. International Energy Agency.
- IEA. (2021b). Net Zero by 2050 – A Roadmap for the Global Energy Sector. International Energy Agency.
- IEA. (2022a). Is the European Union on track to meet its REPowerEU goals? – Analysis. International Energy Agency.
- IEA. (2022b). Price distribution of electric cars compared to overall car market in the European Union, 2021-2022 [dataset]. International Energy Agency.
- IEA. (2023a). Global EV Outlook 2023: Catching up with climate ambitions (GEVO). International Energy Agency.
- IEA. (2023b). Greece 2023, Energy Policy Review. International Energy Agency.
- IEA. (2023c). Italy 2023, Energy Policy Review. International Energy Agency.
- IEA. (2023d). Lithium-ion battery manufacturing capacity, 2022-2030. International Energy Agency.
- IEA. (2023e). Romanian Wind Energy Association training schools in coal regions. International Energy Agency.
- IEA. (2023f). Tracking Clean Energy Progress – Methodology. International Energy Agency.
- IEA. (2023g). World Energy Investment 2023. International Energy Agency.
- IEA. (2023h). World Energy Outlook 2023. International Energy Agency.
- IEA. (2024a). Energy Technology RD&D Budgets Data Explorer. International Energy Agency.
- IEA. (2024b). Greece, overview. International Energy Agency.
- IEA. (2024c). Hungary, Overview. International Energy Agency.
- IEA. (2024d). Slovak Republic, overview. International Energy Agency.
- IEA. (2024e). Global Critical Minerals Outlook 2024. International Energy Agency.
- IEEP. (2023). European Green Deal Barometer 2023. Institute for European Environmental Policy.
- Interreg. (2024). NiCE - Revitalising fading city centres. Interreg Central Europe.
- IPCC. (2018). Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways. Intergovernmental Panel on Climate Change.
- IPCC. (2022a). Agriculture, Forestry and Other Land Uses (AFOLU). In *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change.
- IPCC. (2022b). *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change.

- IPCC. (2023). AR6 Synthesis Report: Climate Change 2023. Intergovernmental Panel on Climate Change.
- ITA. (2022). Sweden Electric Vehicles Market Overview. International Trade Administration.
- Jansen, J., Jager, P., & Redeker, N. (2023). For climate, profits, or resilience? Why, where and how the EU should respond to the Inflation Reduction Act. Jacques Delors Centre.
- JRC ESDAC. (2023). C41 Soil organic matter in arable land. Joint Research Centre - European Soil Data Centre.
- Kadiri, I. (2024a). Poland's Incentives For EV Charging Infrastructure. AMPECO.
- Kadiri, I. (2024b). Portugal's EV Charging Infrastructure Incentives. AMPECO.
- Kahlen, L., Outlaw, I., & Kachi, A. (2023). Climate Audit of the EU's Foreign Policy. NewClimate Institute.
- Kasy, M., & Lehner, L. (2023). Employing the Unemployed of Marienthal: Evaluation of a Guaranteed Job Program. IZA Institute of Labor Economics.
- Katsarova, I. (2024a). Legislative framework for sustainable food systems. European Parliament.
- Katsarova, I. (2024b). Proposal for a harmonised mandatory front-of-pack nutrition labelling. European Parliament.
- KfW. (2024). Förderprodukte für Energie und Umwelt. Kreditanstalt für Wiederaufbau.
- KNOCA. (2023). National Climate Assemblies. Knowledge Network on Climate Assemblies.
- Kögel, N. (2024). Policy integration: Enhancing the social dimension in climate policy planning instruments in the EU. An assessment of Member States' NECPs, TJTPs & RRP. Ecologic Institute.
- Kotilainen, K., Aalto, P., Valta, J., Rautiainen, A., Kojo, M., & Sovacool, B. (2019). From path dependence to policy mixes for Nordic electric mobility: Lessons for accelerating future transport transitions. *Policy Sciences*, 52.
- KPMG. (2021). Tax Alert: New support scheme launched by the National Fund for Environmental Protection and Water Management – "My Electric Vehicle." Klynveld Peat Marwick Goerdeler.
- Kreusel, J., Timbus, A., & Oudalov, A. (2022). Enabling Europe's net zero vision by proactively developing its power grids. Hitachi Energy.
- Kulovesi, K., Oberthür, S., Van Asselt, H., & Savaresi, A. (2024). The European Climate Law: Strengthening EU Procedural Climate Governance? *Journal of Environmental Law*.
- Küster, F. (2023). An analysis of cycling investments by EU Member States using EU Structural Funds. European Cyclists' Federation.
- Lander, L., & Grazia, T. (2023). Why surging sales of large electric vehicles raises environmental red flags. *The Conversation*.
- Le Den, X., Steinmann, J., Kockat, J., Zsolt, T., Röck, M., Allacker, K., & Kovacs, A. (2023). Supporting the development of a roadmap for the reduction of whole life carbon of buildings: Final report. Publications Office of the European Union.
- Lee, H., Pugh, T. A. M., Patacca, M., Seo, B., Winkler, K., & Rounsevell, M. (2023). Three billion new trees in the EU's biodiversity strategy: Low ambition, but better environmental outcomes? *Environmental Research Letters*, 18(3), 034020.
- Liebreich, M. (2023). Hydrogen Ladder Version 5.0. Liebreich Associates.
- Liu, Y., Zhu, J., Padi Tuwor, C., Ling, C., Yu, L., & Yin, K. (2023). The impact of COVID-19 pandemic on global trade-embodied carbon emissions. *Journal of Cleaner Production*.
- Liu, Z., Song, J., Kubal, J., Susarla, N., Knehr, K., Islam, E., Nelson, P., & Ahmed, S. (2021). Comparing total cost of ownership of battery electric vehicles and internal combustion engine vehicles. *Energy Policy*, 158.
- Lowell, D., & Culkin, J. (2021). Medium- & Heavy-Duty Vehicles Market structure, Environmental Impact, and EV Readiness. M.J. Bradley & Associates.
- Mackintosh, S. P. M. (2024). China Doubles Down on Green Tech and the Energy Transition. Project Syndicate.
- Mantzios, L., Matei, N. A., Mulholland, E., Rózsai, M., Tamba, M., & Wiesenthal, T. (2018). JRC-IDEES 2015.
- Marcu, A., Fernando López Hernández, J., Romeo, G., Faure, A., Bo, Q., O'Neill, M., Caneill, J.-Y., & Schleicher, S. (2023). 2023 State of the EU ETS Report. European Roundtable on Climate Change and Sustainable Transition.
- Margaras, V., & Jensen, L. (2022). Certification of carbon removals. European Parliamentary Research Service.
- Marshall, R. (2023). Threat to the energy transition from capital costs. S&P.
- Matthews, D. (2024). US holds off China challenge in global R&D spending race. *Science Business*.
- Melissa, R. (2024). Navigating Europe's EV Charging Expansion. Statzon.
- Messetchkova, I. (2021). Statement on International Public Support for the Clean Energy Transition. UN Climate Change Conference (COP26) at the SEC.

- Meyer-Ohlendorf, N., Siemons, A., Schneider, L., & Böttcher, H. (2023). Certification of Carbon Dioxide Removals: Evaluation of the Commission Proposal. Ecologic Institute, Öko-Institut. Publisher: German Environment Agency.
- Morrison, K., & Wappelhorst, S. (2024). Keep up the good sales: Ways to support the market for used BEVs in Germany. The International Council on Clean Transportation.
- NAL. (2022). Dutch National Charging Infrastructure Agenda. Dutch National Charging Infrastructure Agenda.
- Naumov, S., Keith, D., & Sterman, J. (2022). Accelerating vehicle fleet turnover to achieve sustainable mobility goals. *Journal of Operations Management*, 69(1).
- Niewitata-Rej, M. (2023). Territorial and Distributional Aspects of Just Transition in the updated Italian National Energy and Climate Plan. Reform Institute.
- Nordic Sustainable Construction. (2024). Regulatory needs for harmonising carbon limit values. Nordic Sustainable Construction.
- Oberthür, S. (2024). Review of the Governance Regulation and the European Climate Law: Upgrading the EU's procedural climate governance. Policy options paper. Brussels School of Governance (VUB).
- Oberthür, S., Moore, B., & von Homeyer, I. (2023). Towards an EU Climate Governance Framework to Deliver on the European Green Deal. GreenDeal-NET, VUB Brussels School of Governance Centre for Environment, Economy and Energy.
- Oberthür, S., & Von Homeyer, I. (2023). From emissions trading to the European Green Deal: The evolution of the climate policy mix and climate policy integration in the EU. *Journal of European Public Policy*, 30(3), 445–468.
- ODYSSEE. (2024). Free Energy Indicators. ODYSSEE
- OECD. (2018). Effective Carbon Rates. Organisation of Economic Cooperation and Development.
- OECD. (2020). Green Budgeting Database [dataset]. Organisation of Economic Cooperation and Development.
- OECD. (2021). Effective Carbon Rates. Organisation of Economic Cooperation and Development.
- OECD. (2023). Magma – A Job Guarantee Pilot Project. Organisation of Economic Cooperation and Development.
- OECD & IISD. (2024). Fossil Fuel Subsidies Tracker. Organisation for Economic Co-operation and Development, International Institute for Sustainable Development.
- Panayi, A. (2019). Energy Density and the Challenges of Electrification for Heavy Duty Vehicles [Benchmark]. Benchmark.
- Partington, R. (2023). ECB raises interest rates to highest level since euro launched [Guardian Online]. Guardian.
- Pecurul-Botines, M., Secco, L., Bouriaud, L., Giurca, A., Brockhaus, M., Brukas, V., Hoogstra-Klein, M., Konczal, A., Marcinekova, L., & Niedzialkowski, K. (2023). Meeting the European Union's Forest Strategy goals: A comparative European assessment. European Forest Institute.
- Pestiaux, J., Cornet, M., Jossen, Q., Martin, B., Matton, V., Meessen, J., Taylor, E., & Vermeulen, P. (2018). Net zero by 2050: From whether to how. Zero emissions pathways to the Europe we want. European Climate Foundation.
- Peyruad, J.-L., & MacLeod, M. (2020). Future of EU livestock: How to contribute to a sustainable agricultural sector?: Final report. European Commission.
- PFED. (2023). Public Finance for Energy Database. Energy Finance.
- Pietzcker, R. C., Osorio, S., & Rodrigues, R. (2021). Tightening EU ETS targets in line with the European Green Deal: Impacts on the decarbonization of the EU power sector. *Applied Energy*, 293, 116914.
- Rack, Y. (2021). Europe's distribution grids need at least 50% more investment in 2020s – study. S&P Global Market Intelligence.
- Rajão, R., Soares-Filho, B., Nunes, F., Börner, J., Machado, L., Assis, D., Oliveira, A., Pinto, L., Ribeiro, V., Rausch, L., Gibbs, H., & Figueira, D. (2020). The rotten apples of Brazil's agribusiness. *Science*, 369(6501).
- Ramboll, Ecologic Institute, & CE Delft. (2023). Defining adaptation needs, counting adaptation finance and enabling actions at national and European Level. Report for European Environment Agency.
- République française. (2018). Décret n° 2018-1043 du 28 novembre 2018 créant un label « Bas-Carbone ». Ministère de la Transition écologique et solidaire.
- République française. (2024). Label bas carbone. Ministère de la Transition écologique et de la Cohésion des Territoires.
- Réseau Action Climat. (2023). Le Label Bas-Carbone: Outil d'optimisation ou de transition ? Réseau Action Climat.
- Robert, J. (2023). The EU's climate and energy framework in light of the Aarhus Convention: Assessing environmental democracy rights in the Governance Regulation [Policy report]. Brussels School of Governance (VUB).
- Rodrigues, L., Hardy, B., Huyghebeart, B., Fohrafellner, J., Fornara, D., Barančíková, G., Bárcena, T. G., De Boever, M., Di Bene, C., Feizienė, D., Kätterer, T., Laszlo, P., O'Sullivan, L., Seitz, D., & Leifeld, J. (2021). Achievable agricultural soil carbon sequestration across Europe from country-specific estimates. *Global Change Biology*, 27(24), 6363–6380.
- Rovers, E., & Dejaeghere, Y. (2022). Key drivers of impact How to unleash the potential of climate assemblies. Knowledge Network on Climate Assemblies (KNOCA).

- RSB. (2022). Annual Report 2022. Regulatory Scrutiny Board, European Commission.
- Rudolph, F., Riach, N., & Kees, J. (2023). Development of Transport Infrastructure in Europe: Exploring the shrinking and expansion of railways, motorways and airports. T3 Transportation Think Tank gGmbH and Wuppertal Institut für Klima, Umwelt, Energie gGmbH.
- SBTi. (2023). Target dashboard [dataset]. Science Based Targets Initiative.
- Schaffer, L. M., Oehl, B., & Bernauer, T. (2022). Are policymakers responsive to public demand in climate politics? *Journal of Public Policy*, 42(1), 136–164.
- Schröder, P., & Benton, T. (2024). European farmers' protests show the need for a just transition to Net Zero. Chatham House.
- Schumer, C., Jaeger, J., Boehm, S., Jeffery, L., Levin, K., Hecke, J., Fyson, C., Naimoli, S., Majid, A., Lebling, K., Sims, M., Castellanos, S., Nilsson, A., Thwaites, J., Waite, R., Cassidy, E., Geiges, A., Wilson, R., Lee, A., & Singh, N. (2022). Methodology Underpinning the State of Climate Action Series. Bezos Earth Fund, Climate Action Tracker, Climate Analytics, ClimateWorks Foundation, NewClimate Institute, the United Nations Climate Change High-Level Champions, and World Resources Institute.
- Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., & Matthews. (2019). Creating a Sustainable Food Future: A Menu of Solutions to Feed Nearly 10 Billion People by 2050. World Resources Institute.
- Simon, F. (2024). EU closes deal on scaled-back clean tech 'sovereignty fund.' Euractive.
- Sims, T., & Abnett, K. (2023). Germany reaches deal with EU on future use of combustion engines. Reuters.
- Smith, S. M., Geden, O., Minx, J. C., Nemet, G. F., Gidden, M., Lamb, W. F., & Powis, C. (2023). The State of Carbon Dioxide Removal Report 2023.
- SolarPower Europe. (2023). EU Solar Jobs Report 2023 – Bridging the solar skills gap through quality and quantity. SolarPower Europe.
- SolarPower Europe. (2024). New report: EU solar reaches record heights of 56 GW in 2023 but warns of clouds on the horizon. SolarPower Europe.
- Sugihara, C., Hardman, S., & Kurani, K. (2023). Social, technological, and economic barriers to heavy-duty truck electrification. *Research in Transportation Business & Management*, 51.
- Tänzler, D., Ivleva, D., & Hausotter, T. (2021). EU climate change diplomacy in a post-Covid-19 world. adelphi.
- T&E. (2022a). First ever comparison of car taxation in Europe reveals large discrepancies in approaches to EV incentives. *Transport & Environment*.
- T&E. (2022b). The Good Tax Guide—A Comparison of Car Taxation in Europe. *Transport & Environment*.
- T&E. (2023a). E-fuel cars are not zero emission. *Transport & Environment*.
- T&E. (2023b). The corporate cars problem and what Europe can do about it. *Transport & Environment*.
- T&E. (2024a). Europe's BEV market defies odds but more affordable models needed. *Transport & Environment*.
- T&E. (2024b). Transport and Environment Internal Battery Market Analysis [dataset]. *Transport & Environment*.
- Tech for Net Zero. (2021). Impuls 1: Finanzierung von Climate Tech Start-ups. Tech for Net Zero.
- Thaler, R. H., & Sunstein, C. R. (2021). *Nudge: The Final Edition*. Yale University Press.
- The White House. (2023). One Year In, President Biden's Inflation Reduction Act is Driving Historic Climate Action and Investing in America to Create Good Paying Jobs and Reduce Costs. The White House.
- Thies, C., Hüls, C., Kieckhäfer, K., Wansart, J., & Spengler, T. (2022). Project portfolio planning under CO2 fleet emission restrictions in the automotive industry. *Journal of Industrial Ecology*, 26(3).
- Tollman, J., & Pilsner, L. (2021). Paris-Aligned EU External Action for a Climate Just World (p. 56). E3G.
- Tsiropoulos, I., Nijs, W., Tarvydas, D., & Ruiz, C. P. (2020a, April 20). Towards net-zero emissions in the EU energy system by 2050. JRC Publications Repository.
- Tsiropoulos, I., Nijs, W., Tarvydas, D., & Ruiz, P. (2020b). Towards net-zero emissions in the EU energy system by 2050: Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal. (JRC Technical Reports). European Commission, Joint Research Center.
- Udenrigsministeriet. (2023). Joint statement of EU Group of Friends on climate diplomacy, 13 November 2023.
- UKCCC. (2022). CCC Monitoring Framework. UK Climate Change Committee.
- University of Notre Dame. (2023). Rankings // Notre Dame Global Adaptation Initiative. University of Notre Dame.
- Vallone, S., & Lambin, E. F. (2023). Public policies and vested interests preserve the animal farming status quo at the expense of animal product analogs. *One Earth*, 6(9), 1213–1226.
- Velasco, I. A., & Peters, J. (2022). How EU Trade Deals Can Increase Climate Action [Briefing Paper]. E3G.

- Velten, E. K., Evans, N., Spasova, D., Duwe, M., de la Vega, R., Duin, L., & Branner, H. (2022). Charting a path to net zero: An assessment of national long-term strategies in the EU. Ecologic Institute.
- Velten, E. K., Haase, I., Berghmans, N., Duwe, M., & Evans, N. (2021). Measuring progress towards climate neutrality—Part I: Assessing structural change through net zero indicators (ECF Net-Zero 2050 Series). Ecologic Institut, IDDRI.
- Vennin, S., & Angerand, S. (2023). Low carbon, high risk—Lessons for the EU from Label Bas-Carbone forestry projects in France. fern.
- Wacket, M., & Abnett, K. (2023). Germany forms alliance against phase-out of internal combustion engines by 2035. Reuters.
- Wappelhorst, S., Hall, D., Nicholas, M., & Lutsey, N. (2020). Analyzing Policies to Grow the Electric Vehicle Market in European Cities. The International Council on Clean Transportation.
- Weiss, M., Cloos, K. C., & Helmers, E. (2020). Energy efficiency trade-offs in small to large electric vehicles. *Environmental Sciences Europe*, 32.
- Weyand, S. (2021). Sabine Weyand on role of trade policy in fighting climate change. *The Economist*.
- Wikström Avaria, A. (2023). PETI Fact-finding visit to Romania—15—18 May 2023 On the management and protection of the brown bear population and illegal logging in Romania | Think Tank | European Parliament. Policy Department for Citizens' Rights and Constitutional Affairs.
- WindEurope. (2024). The EU built a record 17 GW of new wind energy in 2023 – wind now 19% of electricity production. WindEurope.
- Wisser, D., Özkan, Ş., Lanzoni, L., Tempio, G., Tubiello, F. N., Uwizeye, A., Piquet, C. L., Cinardi, G., Reppin, S., Dondini, M., Robinson, T. P., & Rulli, M. (2023). Pathways to lower emissions: A global assessment of the greenhouse gas emissions and mitigation options from livestock agrifood systems. Food and Agriculture Organization of the United Nations.
- W&K Grant Thornton. (2021). German Act on Tax Incentives for R&D (FZuLG). W&K Grant Thornton.
- WWF. (2020a). EU Forest Crime Initiative—Gap Analysis: Romania. World Wide Fund For Nature.
- WWF. (2020b). WWF sounds the alarm: Romania won't stop illegal logging. World Wide Fund For Nature.
- WWF. (2023). Who Determines the Cost of Food? World Wide Fund For Nature EU.
- Zubaşcu, F. (2024). Horizon Europe budget to be cut by €2.1B, as defence research gets a €1.5B boost. Science Business.

## Legal references

- Alternative Fuels Infrastructure Regulation: Regulation (EU) 2023/1804 of the European Parliament and of the Council of 13 September 2023 on the deployment of alternative fuels infrastructure.
- Aarhus Regulation: Regulation (EC) 1367/2006 of the Council of 6 September 2006 on the application of the provisions of the Aarhus Convention on access to information, public Participation in decision-making and access to justice in environmental matters to Union institutions and bodies.
- Aarhus Regulation Amendment: Regulation (EU) 2021/1767 of the European Parliament and of the Council of 6 October 2021.
- Capital Requirements Directive (CRD): Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms.
- CCS Directive: Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide.
- Code forestier (nouveau): Partie législative (Articles L111-1 à L378-1).
- Corporate Sustainability Due Diligence Directive (CSDDD): Directive of the European Parliament and of the Council on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937
- Corporate Sustainability Reporting Directive (CSRD): Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting
- CO2 Emission Performance Standards for cars and vans, and for trucks: Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles; and Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO2 emission performance standards for new heavy-duty vehicles.
- Critical Raw Materials Act (CRMA): Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials.
- Ecodesign Directive: Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

- Energy Taxation Directive: Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity.
- Energy Efficiency Directive (EED): Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency, and amending Regulation (EU) 2023/955 (recast).
- Eighth Environmental Action Programme (8th EAP): Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030.
- Energy Performance of Buildings Directive (EPBD): Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.
- EU Climate Law: Regulation (EU) 2021/1119 of the European Parliament and of the Council establishing the framework for achieving climate neutrality.
- EU Timber Regulation (EUTR): Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market.
- EU ETS Directive (EU ETS and EU ETS 2): Directive (EU) 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union.
- Federal Forest Act (BWaldG): Gesetz zur Erhaltung des Waldes und zur Förderung der Forstwirtschaft (Bundeswaldgesetz).
- Glasgow Climate Pact: United Nations Framework Convention on Climate Change (UNFCCC), Glasgow Climate Pact, FCCC/PA/CMA/2021/L.16.
- Governance Regulation (GovReg): Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action.
- LULUCF Regulation: Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework.
- Renewable Energy Directive (RED III): Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.
- Sustainable Finance Taxonomy: Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment.
- TEN-E Regulation: Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure.

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## Abbreviations

<b>AFIR</b>	Alternative Fuels Infrastructure Regulation
<b>BECCS</b>	Bioenergy carbon capture and storage
<b>BEVs</b>	Battery Electric Vehicles
<b>bnEUR</b>	Billion Euro
<b>BPIE</b>	Buildings Performance Institute Europe
<b>CAP</b>	Common Agricultural Policy
<b>CAPR</b>	Climate Action Progress Report
<b>CAT</b>	Climate Action Tracker
<b>CATF</b>	Clean Air Task Force
<b>CBAM</b>	Carbon border adjustment mechanism
<b>CCU</b>	Carbon Capture and Utilisation
<b>CCS</b>	Carbon Capture and Storage
<b>CDR</b>	Carbon Dioxide Removal
<b>CE</b>	Circular Economy
<b>CEAP</b>	Circular Economy Action Plan
<b>CEF</b>	Connecting Europe Facility
<b>CFCR</b>	Certification Framework for Carbon Removals
<b>CPI</b>	Climate Policy Integration
<b>CRD</b>	Capital Requirements Directive
<b>CRMA</b>	Critical Raw Materials Act
<b>CSDDD</b>	Corporate Sustainability Due Diligence Directive
<b>CSRD</b>	Corporate Sustainability Reporting Directive
<b>DACCS</b>	Direct Air Carbon Capture and Storage
<b>DESNZ</b>	Department for Energy Security and Net Zero
<b>DG</b>	Directorate-General
<b>DGAL</b>	General Directorate for Food
<b>EAFO</b>	European Alternative Fuels Observatory
<b>EBA</b>	European Banking Agency
<b>EC</b>	European Commission
<b>ECA</b>	European Court of Auditors

<b>EEA</b>	European Environment Agency
<b>EEAS</b>	European External Action Service
<b>EED</b>	Energy Efficiency Directive
<b>EHPA</b>	European Heat Pump Association
<b>EIB</b>	European Investment Bank
<b>EP</b>	European Parliament
<b>EPAC</b>	Electrically Power Assisted Cycle
<b>EPBD</b>	Energy Performance of Buildings Directive
<b>EPRS</b>	European Parliamentary Research Service
<b>EPS</b>	Emission Performance Standards
<b>ESABCC</b>	European Scientific Advisory Board on Climate Change
<b>ETS</b>	Emissions Trading System
<b>EU</b>	European Union
<b>EUCO</b>	European Council
<b>EUDR</b>	EU Deforestation Regulation
<b>EU GBRF</b>	EU Green Budget Reference Framework
<b>EUGD</b>	European Green Deal
<b>EUR</b>	Euro
<b>EUTR</b>	EU Timber Regulation
<b>EV</b>	Electric Vehicle
<b>FCEV</b>	Fuel Cell Electric Vehicle
<b>FFS</b>	Fossil Fuel Subsidies
<b>FP10</b>	Framework Programme 10
<b>FTA</b>	Free Trade Agreement
<b>F2F</b>	Farm to Fork Strategy
<b>GDP</b>	Gross Domestic Product
<b>GHG</b>	Greenhouse Gas
<b>GWh</b>	Gigawatt Hour
<b>HDV</b>	Heavy-Duty Vehicle
<b>ICE</b>	Internal Combustion Engine
<b>ICMS</b>	Industrial Carbon Management Strategy
<b>IDOS</b>	Institute of Development Studies

<b>IEA</b>	International Energy Agency
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRA</b>	Inflation Reduction Act
<b>JETP</b>	Just Energy Transition Partnership
<b>JRC</b>	Joint Research Centre
<b>JTF</b>	Just Transition Fund
<b>LDV</b>	Light-Duty Vehicle
<b>LNG</b>	Liquid Natural Gas
<b>LTS</b>	Long-Term Strategy
<b>LULUCF</b>	Land Use, Land-Use Change and Forestry
<b>MEPS</b>	Minimum Energy Performance Standards
<b>MFF</b>	Multiannual Financial Framework (EU budget)
<b>MS</b>	Member States
<b>NCQG</b>	New Collective Quantified Goal
<b>NECP</b>	National Energy and Climate Plan
<b>NECPR</b>	National Energy and Climate Plan Progress Report
<b>N2O</b>	Nitrous Oxide
<b>NZEB</b>	Nearly Zero-Energy Buildings
<b>NZIA</b>	Net Zero Industry Act
<b>ODA</b>	Official Development Assistance
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>PA</b>	Paris Agreement
<b>PCE</b>	Private Consumption Expenditure
<b>PPS</b>	Purchasing Power Standard
<b>RED</b>	Renewable Energy Directive
<b>REPowerEU</b>	Renewable Energy Power for the European Union
<b>RFF</b>	Recovery and Resilience Facility (NextGenerationEU)
<b>RFNBO</b>	Renewable Fuel of Non-Biological Origin
<b>R&amp;D</b>	Research and Development
<b>R&amp;I</b>	Research and Innovation
<b>RSB</b>	Regulatory Scrutiny Board
<b>SBTi</b>	Science Based Targets initiative

<b>SCF</b>	Social Climate Fund
<b>SSMS</b>	Sustainable and Smart Mobility Strategy
<b>STEP</b>	Strategic Technologies for Europe Platform
<b>T&amp;E</b>	Transport & Environment
<b>UKCCC</b>	UK Climate Change Committee
<b>UNEP</b>	United Nations Environment Programme
<b>VAT</b>	Value Added Tax
<b>WTO</b>	World Trade Organisation
<b>ZEB</b>	Zero Emission Building
<b>ZEV</b>	Zero Emission Vehicle



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