

European Environment Agency



Trends and projections in Europe 2025

EEA Report

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This report explores the historical trends, most recent progress and projected future developments in climate change mitigation through reduced greenhouse gas emissions, renewable energy gains and improved energy efficiency. It builds upon data reported by all 27 European Union (EU) Member States, five European Environment Agency (EEA) member countries and nine Energy Community contracting parties.

A technical background document accompanies this report, providing further detail on the data sources and targets referenced throughout.

Please find a digital version of all figures contained in this report at the following link: eea.europa.eu/en/analysis/publications/trends-and-projections-in-europe-2025

Unless otherwise stated, the following definitions and scope apply:

- EU refers to the EU-27.
- Projections reflect those submitted by countries in 2025 under Article 18 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.
- Greenhouse gas emissions are expressed using global warming potentials from the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC).

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Executive summary

The EU is making steady progress towards climate neutrality

2024 was Europe's warmest year on record, with central, eastern and south-eastern Europe experiencing unprecedented temperatures. At the same time, parts of Europe faced widespread flooding, while south-eastern Europe endured its driest summer in 12 years (EEA, 2025e). The impact of climate change is increasingly evident — across the economy, nature and human well-being. Expressed in monetary terms, the costs of inaction far exceed the investments needed to mitigate climate change (EEA, 2024c).

As a result, 85% of Europeans (EU, 2025) consider climate change a major global problem requiring decisive action. Reducing greenhouse gas (GHG) emissions goes hand in hand with building a resilient economy. Phasing out fossil fuels not only supports climate action but also reduces dependence on expensive imported energy, for which prices can be volatile. Furthermore, a phase out of fossil fuels creates opportunities for innovation, industrial development and clean technology growth. With relatively high energy prices in the EU and global markets, the EU is taking a carefully balanced approach: reducing emissions while protecting industry competitiveness and supporting households. The European Climate Law sets a clear goal: to reduce GHG emissions and avoid the worst effects of climate change — a global challenge in which the EU aims to be a frontrunner.

Now halfway between the start of this century and 2050, the EU is largely on track towards climate neutrality. Fundamental changes in the energy system, technological innovation in industry and greater public awareness have together driven a 39% reduction in emissions by 2024 compared with 1990 levels. Including emissions from international aviation and maritime transport (as covered under the European Climate Law (ECL)), the overall reduction amounts to 37%, reflecting slower progress in those sectors.

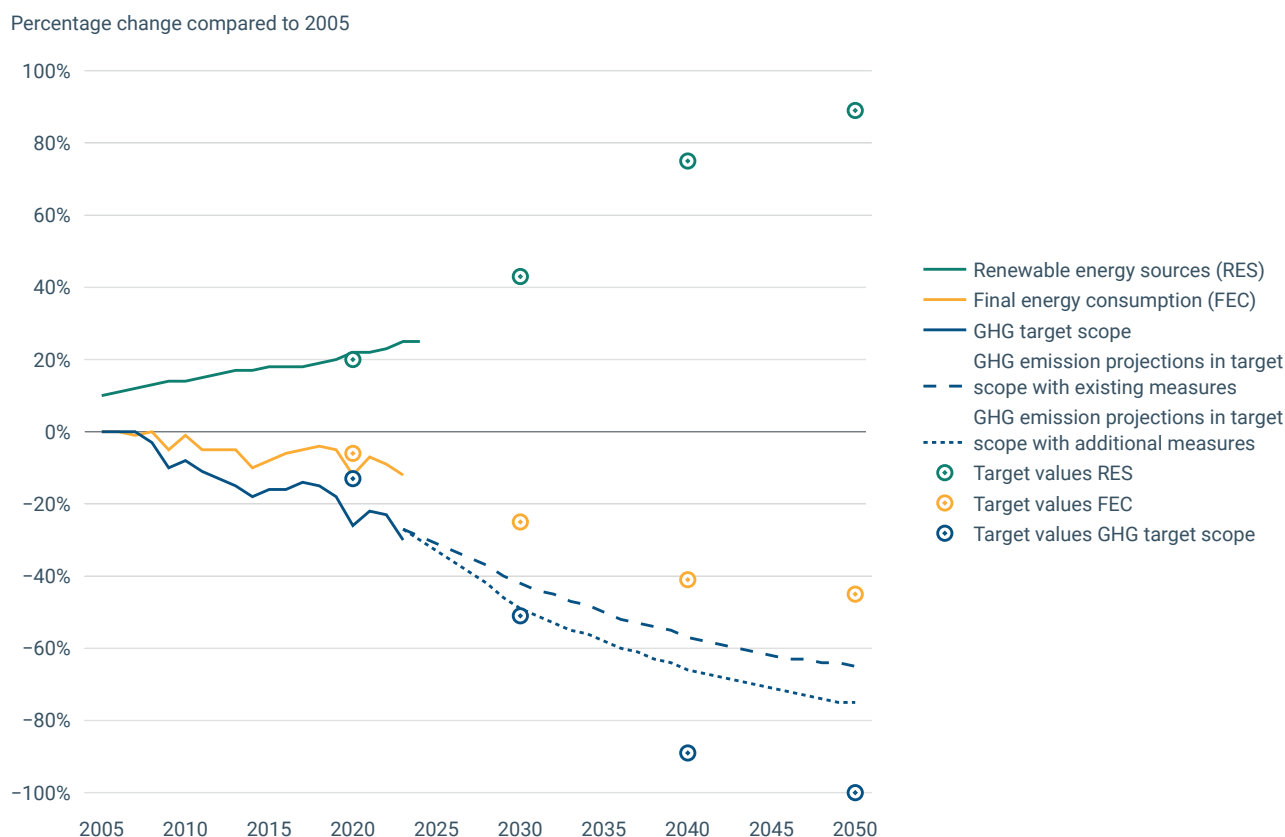
The pace of emission reductions has accelerated in recent decades. Between 1990 and 2005, emissions decreased by an average of 0.5% of 1990 baseline levels per year; since 2005, the annual reduction rate has more than doubled.

Over the past five years, fully accounting for the strengthened governance framework and faster deployment of key technologies, the EU's GHG emissions have on average decreased by nearly 3% per year relative to 1990 levels. If this pace continues, the EU is on the path towards climate neutrality.

The GHG projections included in this report also support this outlook. Collectively, Member States expect to achieve a net reduction of 54% by 2030 compared with 1990, close to the 55% target ⁽¹⁾. Achieving this depends on effectively implementing planned measures, as around 6.5 percentage points of the total reduction rely on planned measures not yet enacted in legislation.

⁽¹⁾ GHG projections submitted in 2025 showed considerable reference year variability, resulting in the gap between the inventories and projections in 2022-2023 that is visible in Figure ES.1. More information on projections is available in Section 2 of the Technical Background Report, which is published alongside this report.

Figure ES.1 EU 2020 achievement and progress towards 2030 and 2050 climate and energy targets



Notes: This figure shows EU progress since 2005 on reducing GHG emissions, increasing the renewable energy share and reducing energy consumption. The EU's total net GHG emissions include all emissions and removals regulated by EU law. Data for 2005-2023 are from Eurostat (2025b, 2025j), and EEA (2025b); 2024 values are EEA estimates. The aggregated GHG emissions projections are based on Member State submissions in 2025 under Article 18 of the Governance Regulation. Reference points for 2030 refer to the targets outlined in the 2030 legislative framework (EU, 2021, 2023d, 2023c). For GHG, the reduction in 2040 relates to the EC recommendation (EC, 2024d) and for 2050 it aligns with the EU's net climate neutrality goal. The reference points for renewable energy and final energy consumption in 2040 and 2050 represent the results of scenario S3 in the 2040 impact assessment (EC, 2024b).

Sources: Author's compilation based on data from Eurostat (2025b, 2025j), EEA (2025b), EEA (forthcoming, 2025i).

The overall reduction since 1990 has been driven mainly by the energy transition. The EU has significantly reduced the use of the most emission-intensive fuels, such as coal and oil, while accelerating the development of renewable energy. By 2024, total energy consumption by end users in Europe (such as energy used by households to heat buildings, industries to manufacture products and energy used in the transport sector) was more than 13% lower than in 2005. Considering primary energy consumption – reflecting the raw energy inputs required to deliver final energy – the reduction was nearly 19%. This indicates a more efficient transformation of raw energy into usable forms.

In addition to this overall decline in energy use, fossil fuel consumption – the main source of GHG emissions – fell markedly. Since 2005, total fossil fuel input fell by nearly 30% and coal consumption more than halved. This shift was enabled by a steadily growing share of energy from renewable sources.

In 2024, one in four units of energy used in Europe was of renewable origin; renewables supplied 47% of electricity. These figures confirm that the energy transition is well underway, while highlighting the need for continued acceleration.

The EU has set a common target of at least 42.5% renewable energy by 2030 and further reductions in energy consumption. The distance to these goals remains significant. To reach the 2030 renewables target on time, annual additions of renewable energy capacity must more than double compared to the previous five-year average. For final energy consumption, annual reductions must be 16% higher than the previous five-year average.

These ambitions are achievable but require full and broad implementation of legislation and maximum efforts to scale the enablers of the transition. Technologies such as heat pumps and electric vehicles (EVs) are crucial, as they can substantially cut related GHG emissions and significantly reduce final energy use compared with fossil-based alternatives.

With drastic reductions in the energy supply sector, transport is now the biggest source of GHG emissions

When trends are examined across economic sectors, clear differences emerge.

The energy supply sector — including electricity and heat generation as well as refineries — reduced its emissions by 49% between 2005 and 2023. Over the past five years, this sector has seen a sharp acceleration in emission reductions, reflecting the ongoing renewable energy transition, with cuts occurring almost twice as fast as in the overall economy. Once the EU's largest source of emissions, energy production no longer represents the greatest emitting sector and is on track to deliver further deep reductions in line with the sector's indicative trajectory set out in the EC's 2030 target modelling.

Transport-related emissions have declined far more slowly, falling by only 6% since 2005 for domestic transport activity. Transport is now Europe's largest sectoral source of emissions. Although technological improvements have reduced the GHG intensity of new vehicles, persistent high demand for transport has limited overall progress. As a result, there remains a 25 percentage point gap between 2023 emissions and the indicative 2030 sectoral trajectory.

The buildings sector has achieved a 34% reduction in emissions since 2005, mainly due to improved energy efficiency in the building stock and higher standards for new construction. However, to meet the indicative 2030 sectoral trajectory of a 63% reduction, further advances are required. These include increasing the renovation rate of EU housing stock — a key step both to reducing emissions and lowering fossil fuel costs for households.

The industrial sector has reduced emissions by 36% since 2005, largely thanks to process improvements, reductions in non-CO₂ gases like N₂O and greater energy efficiency. Industrial emissions are on track to meet the sector's indicative 2030 trajectory, but the sector faces the challenge of transitioning to zero carbon technologies while maintaining competitiveness.

In the agriculture sector, emission reductions have been slower than in other sectors, resulting in a 7% cut since 2005. This more limited reduction was anticipated in the indicative 2030 trajectory and the sector had already nearly reached its indicative 2030 level by 2023.

The land use, land use change and forestry (LULUCF) sector deserves special attention. As the only sector that removes GHGs from the atmosphere, through CO₂ capture and storage in forests and soils, it plays a crucial role. In 2023, LULUCF offset 6% of total EU emissions. However, its removal capacity has declined significantly, averaging 30% lower over the past decade than in the previous one. This trend must be reversed to achieve the 2030 LULUCF target and ensure its continued contribution to overall net emission reductions.

International transport emissions – covering aviation and maritime activity – follow distinct patterns. Emissions from international aviation more than doubled between 1990 and 2019. During the COVID-19 pandemic, they fell back to roughly 1990 levels but have since rebounded to 2019 levels, with further growth projected. By contrast, international maritime emissions increased steadily from 1990 to 2007 and have remained relatively stable since 2013, currently standing at 26% above 1990 levels. Under EU law, part of international transport emissions are included within the EU's target scope. For 2023, 47% of international aviation emissions and 67% of emissions from international maritime emissions were included in the calculation of EU progress towards GHG reduction targets.

Figure ES.2 Sectoral comparison for 2005 and 2024 compared with the EC's indicative sectoral trajectory for 2030



Note: MtCO₂e, million tonnes of CO₂ equivalent.

Source: Author's compilation based on data from EEA (2025b), EC (EC, 2024b).

2024 estimates confirm positive trends, but highlight the need for further action

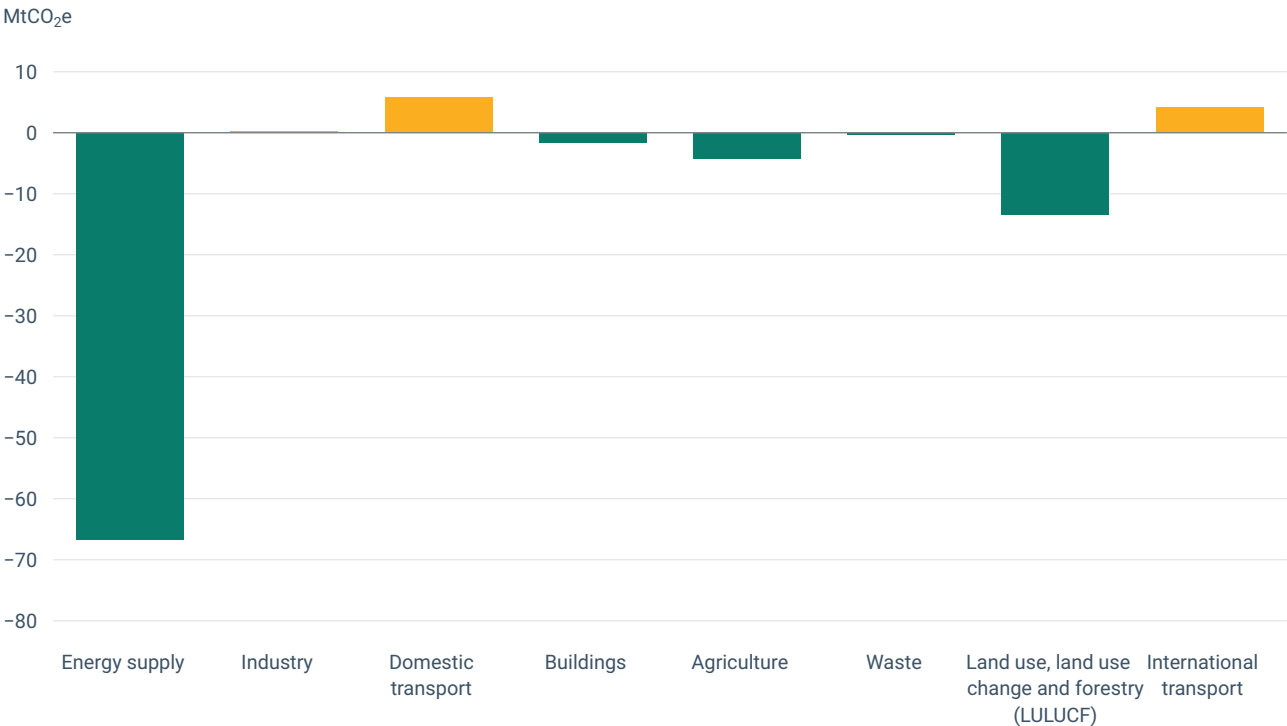
The 2024 estimates presented in this report largely confirm established trends. Total net GHG emissions are estimated to have fallen by a further 2.5% (under the scope of European Climate Law) over the course of 2024, continuing the downward trend observed over the past five years.

In terms of energy use, preliminary data indicate that final energy consumption decreased by 0.9% in 2024 compared with 2023, while the share of renewable energy grew by 0.9 percentage points, reaching a level of 25.4% in 2024.

Although these overall trends continue to move in the right direction, progress towards the 2030 targets has slowed. As in recent years, the largest emissions reduction in 2024 occurred in the energy supply sector (see Figure ES.3), but this accounted for less than half of the decrease recorded in 2023, which was nonetheless exceptional.

Emission reductions in other sectors were more limited and emissions increased in both domestic and international transport, and marginally in industry.

Figure ES.3 Change in EU GHG emission across sectors: 2024 vs 2023



Notes: This figure presents the change in emissions for each sector in 2023 compared to 2024. The 'Energy supply' sector covers GHG emissions inventory categories 1.A.1 and 1.B; 'Industry' covers 1.A.2 and 2; 'Domestic transport' covers 1.A.3; 'Buildings' covers 1.A.4 +1.A.5; 'Agriculture' covers category 3; 'Waste' covers category 5; 'LULUCF' is covered as reported under category 4; 'International transport' is covered as included under target scope.

MtCO₂e, million tonnes of CO₂ equivalent.

Sources: Author's compilation based on data from EEA (forthcoming, 2025b).

National targets as drivers of the climate transition

The EU-wide patterns presented in this report reflect aggregated outcomes across Member States. However, examining national level trends provides a more detailed assessment.

In terms of GHG emissions, some countries are already close to climate neutrality, while others have seen slower progress. There are also major differences in renewable energy uptake and technology adoption. In 2023, the share of renewables in gross final energy consumption ranged from around 66% in some Member States to 14% in others.

Under the EU governance framework, Member States have two overarching binding targets for achieving net GHG emission reductions:

- They must meet binding national GHG emission limits under the Effort Sharing Regulation (ESR), which covers emissions from transport, buildings, agriculture, waste and small industry.
- They must achieve additional net GHG removals through their LULUCF sector.

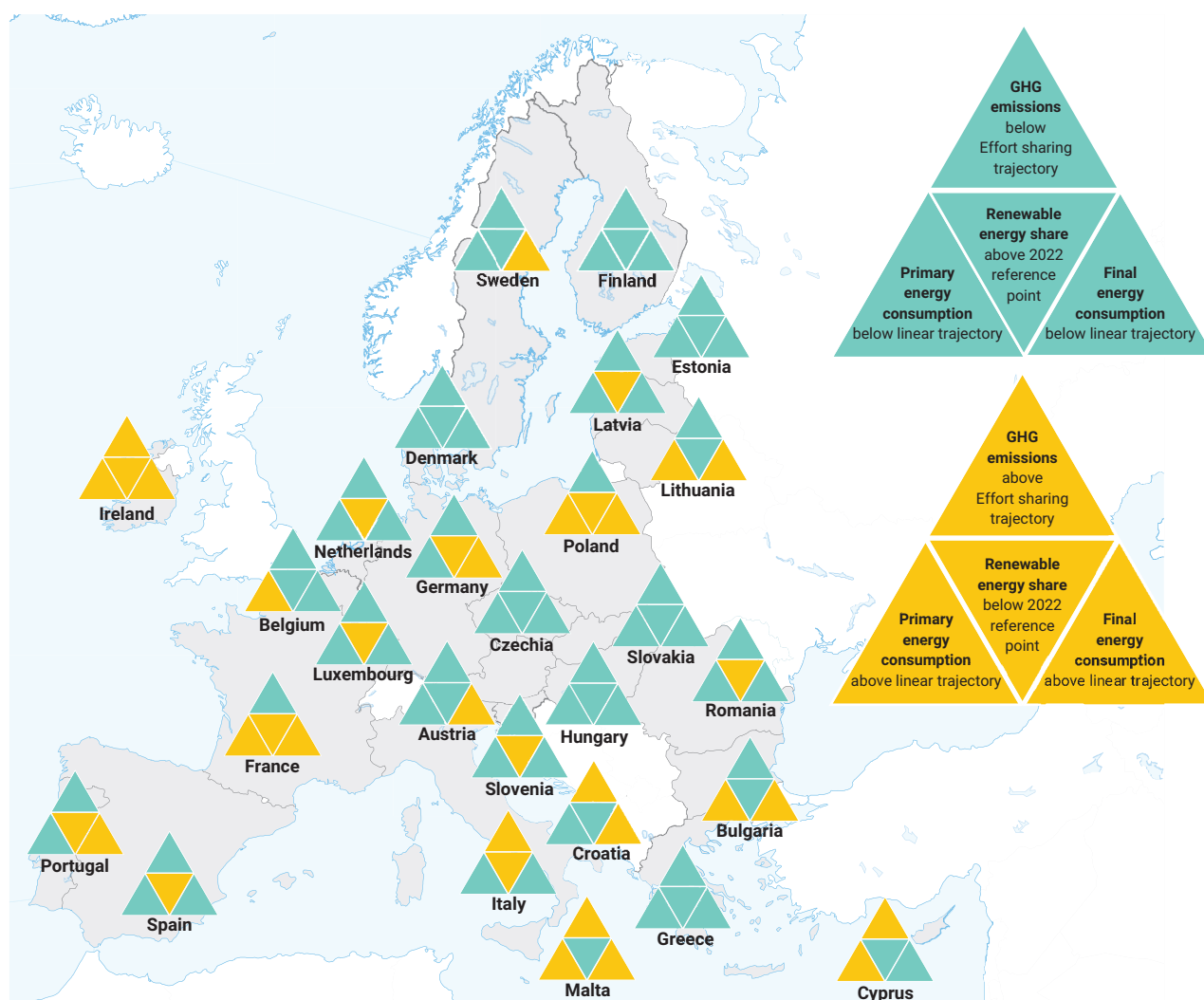
For the ESR targets, 21 Member States were on track towards their 2030 trajectories in 2023, while six recorded ESR emissions above their indicative paths.

For LULUCF, the picture is less positive. Reflecting the EU-wide decline, 19 Member States reported removals below the targeted change compared with the 2016-2018 reference period, even though all Member States have targets to strengthen removal capacity by 2030 ⁽²⁾. According to Member States' projections, there remains a considerable gap to the EU-wide target sink of additional 42MtCO₂e (million tonnes of CO₂ equivalent) in 2030, compared with the 2016-2018 average.

⁽²⁾ This analysis is complementing the official gap to target calculation of Article 4 of the LULUCF Regulation of the EC performed as part of the Climate Action Progress Report 2025.

Member States must step up efforts to reach 2030 targets

Figure ES.4 Assessing Member States' 2023 climate and energy performance



Notes: This figure illustrates the 2023 climate and energy performance of Member States. For GHG emissions, it compares reviewed 2023 GHG emissions under the ESR with the annual emission allocation (AEA) for 2023. This is a first step towards the assessment of 2023 progress, given that Member States have flexibilities under the ESR to match the AEA with its emissions. For primary and final energy consumption, the figure compares national energy consumption in 2023 with a 2023 trajectory value based on a linear trajectory between the 2020 national target and the 2030 national contribution as included in the National Energy and Climate Plan submitted in 2024. For renewable energy it compares the 2023 renewable energy share with the interpolated value for the year 2023 between reference points under the Governance Regulations 2022 and 2025 as reported in National Energy and Climate Plans.

Sources: Author's compilation based on data from EEA (2025h), EU (2023a), Eurostat (2025b, 2025j), EC (2020a) .

Staying on the course

The analysis presented in this report concludes that the EU remains on track towards climate neutrality. Continued reductions in emissions, sustained progress in the energy transition and projections submitted by Member States clearly demonstrate the achievements of recent decades and reinforce the EU's long-term ambition to reach climate neutrality.

At the same time, several subtle but significant developments observed in 2024 require focused attention in the years ahead to maintain progress. These include a decline in EV sales, stagnation in GHG emission reductions in certain sectors and Member States, and the ongoing reduction in the carbon removal capacity of the EU's forests and soils. Together, these trends highlight the need to maintain strong focus and investment in climate action.

1 Greenhouse gas emissions and energy trends in the EU

Key messages

- In 2023, the EU's net GHG emissions were 37% below 1990 levels, or 35.6% when international transport, in the scope of the European Climate Law (ECL), is included. Over the same period, real gross domestic product (GDP) grew by nearly 70%, underlining the decoupling of economic growth from emissions.
- Energy consumption also declined: final energy consumption fell by 12% between 2005 and 2023, while primary energy consumption by 19%. Fossil fuel use dropped almost 30% and renewable energy supplied one quarter of gross final energy consumption in 2023 and nearly half of final energy consumption for electricity generation.
- Preliminary data for 2024 show continued, though less pronounced, reductions of 2.8% compared with 2023, bringing estimated 2024 net emissions to 39% below 1990 levels. When including international transport in the scope of the ECL, the year-on-year reduction totals 2.5%; the overall reduction compared with 1990 reaches 37%. These data are estimates reported by Member States and compiled and quality checked by the EEA.
- Over the past decade, EU emission reductions have accelerated markedly. Average annual cuts totalled 26MtCO₂e between 1990 and 2005, doubled to 50MtCO₂e per year between 2005 and 2018 and quadrupled to 129MtCO₂e between 2018 and 2023 under the strengthened EU governance framework.
- This rapid pace of reduction achieved over the past five years must be maintained over the next five to ensure the 2030 target is met. In particular, emission cuts in transport — the EU's largest emitting sector since 2023 — and increased net removals in the LULUCF sector must accelerate further.
- Achieving the 2030 goals will require more than doubling annual renewable energy capacity additions and annual energy savings must increase by 16%, compared with the past five-year average. Scaling up clean technologies remains essential to Europe's industrial competitiveness.

1.1 Introduction

The EU has set a clear ambition to become the world's first climate neutral continent. In 2021, the ECL established legally binding targets to reduce net GHG emissions by 55% by 2030 compared with 1990 levels and to achieve climate neutrality by 2050 at the latest.

With the formal agreement of the EU's environment ministers on 5 November 2025, the EU Member States reaffirmed their commitment to climate neutrality by introducing an additional interim target: a 90% reduction in net GHG emissions by 2040.

To support these overarching climate objectives, the EU has also set key targets for transforming the energy system – one to limit energy consumption by 2030 and another to ensure that at least 42.5% of energy consumption comes from renewable sources by that year.

This report monitors the EU's progress towards these goals – at the halfway point of the century's journey towards climate neutrality and five years ahead of the 2030 milestone. It does so by examining historical trends, assessing the latest developments in 2024 and exploring future projections.

This analysis draws primarily on detailed, granular data submitted by Member States to the EEA, in accordance with the Governance Regulation. These data undergo thorough quality checks before being integrated into EU-wide data sets.

In addition to data reported by Member States, the progress presented in this report is complemented by relevant information from EEA member countries that are not part of the EU and from neighbouring countries that are Parties to the Energy Community.

Historical energy data originate from Eurostat, while 2024 energy progress estimates are produced by the EEA. All data, supporting figures and indicators are publicly available on the EEA website, ranging from submitted national reports to aggregated EU-level statistics and indicator-based assessments.

Historical data (1990-2023):

- Greenhouse gas inventory data;
- Final and primary energy consumption data (Eurostat);
- Renewable energy shares (Eurostat).

Preliminary 2024 data:

- Approximated 2024 GHG emissions reported by Member States;
- Estimated 2024 energy consumption and renewable energy data from the EEA and its European Topic Centre on Climate Change Mitigation (ETC CM).

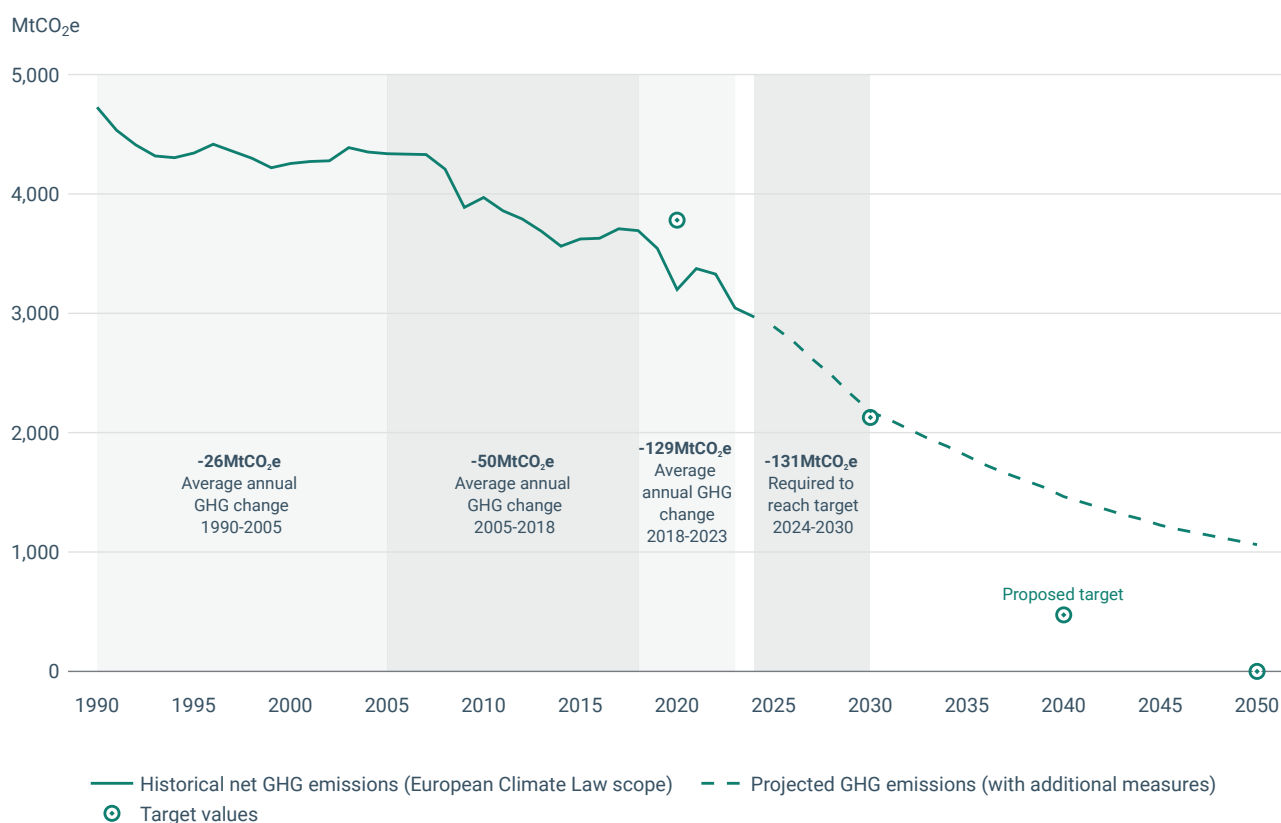
Future evolutions:

- 2025-2050 projected GHG emissions as reported by Member States under the Governance of the Energy Union and Climate Action Regulation (Governance Regulation);
- 2030 contributions for energy consumption and renewable energy as included in Member States' NECPs.

1.2 Progress to 2030 headline targets

1.2.1 Reducing GHG emissions

Figure 1.1 Total net GHG emissions in the EU, 1990-2050



Notes: In this figure, the EU total net GHG emissions include all GHG emissions and removals regulated under the ECL. Estimates of historical emissions from the international aviation and maritime sectors relevant for this scope are based on data derived from the Joint Research Centre's (JRC) Integrated Database of the European Energy System (IDEES) methodology (calculated using JRC (2024a, 2024c)). Target values are drawn from the ECL for 2030 and 2050 (EU, 2021), while for 2040 the -90% target is visualised by applying the percentage reductions to the calculated 1990 baseline values. Data for 1990-2023 originate from EEA (2024a) and the 2024 values are from EEA (forthcoming). The aggregated GHG emissions projections are based on data submitted by Member States in 2025 under Article 18 of the Governance Regulation, taking into account planned additional measures (the 'with additional measures' (WAM) scenario).

MtCO₂e, million tonnes of CO₂ equivalent.

Sources: Author's compilation based on data from EEA (forthcoming), EC (2024d), JRC (2024a, 2024c).

Over the past decades, the EU has reduced its GHG emissions at an accelerating pace. According to the latest GHG inventory data used for this assessment, net GHG emissions in 2023, within the ECL scope, were 35.6% below 1990 levels, as shown in Figure 1.1. Preliminary data for 2024 indicate a reduction of 37% compared with 1990.

These figures include domestic emissions, emissions and removals from the LULUCF sector and emissions from international aviation and international maritime transport, all covered under EU regulations.

During the same period, while GHG emissions fell substantially, the EU's GDP increased by 70%, demonstrating a clear decoupling between economic growth and GHG emissions.

An acceleration in emission reductions over time is evident, reflecting the increasing ambition of EU climate policy. Between 1990 and 2005, average annual emission reductions across the EU amounted to 26MtCO₂e, equivalent to 0.5% of 1990 baseline emissions. This pace doubled to 50MtCO₂e between 2005 and 2018 and more than doubled again to an average reduction of 129MtCO₂e during 2018-2023.

Preliminary figures for 2024 suggest a lower annual reduction of 75MtCO₂e, equivalent to only one quarter of the decrease achieved in 2023.

Looking ahead to 2030, achieving the 55% net emissions reduction target will require an average annual reduction of 131MtCO₂e. If the 2018-2023 trend continues, this target appears within reach.

Moreover, aggregated projections from Member States support a positive outlook. If only existing measures already adopted in legislation are considered, Member States project to reach a 47.4% reduction in 2030. When planned measures but not yet legislated measures are included, the projected reduction rises to 53.9% below 1990 levels, converging closely with the 2030 target.

These data relate to the ECL scope, which sets targets of a net 55% reduction by 2030 and climate neutrality by 2050. This target scope includes net GHG emissions and international transport emissions regulated under EU law, namely those covered by the EU Emissions Trading System (EU ETS):

- emissions from intra-EU aviation and flights to the United Kingdom, Norway and Iceland;
- intra-EU navigation;
- 50% of emissions from journeys between EU and non-EU ports.

For GHG emissions related to international aviation and maritime activities, inventory and projection totals (based on bunker fuel data) are converted using the JRC's IDEES methodology (JRC, 2024a, 2024c) to reflect the emissions covered by the EU ETS.

Table 1.1 Different aggregated scopes for monitoring GHG emission trends

Scope	Domestic GHG emissions	Domestic net GHG emissions	Total GHG emissions under EU law
What emissions are covered?	Emissions from all domestic sectors such as energy, agriculture and industrial processes.	Domestic GHG emissions and emissions and removals from LULUCF activities.	Domestic net GHG emissions and emissions from international aviation and maritime transport as regulated under EU law.
% reduction in 2024 versus 1990	-37.7%	-39.0%	-37.2%
% reduction in 2024 versus 2023	-2.2%	-2.8%	-2.5%
Projected % reduction in 2030 versus 1990 (WAM)	-53.3%	-56.0%	-54.0%

Source: EEA (2025b).



Beyond 2030, the gap between the path towards climate neutrality and projected emissions widens.

Aggregated net GHG emissions based on existing measures are projected to reach 60% below 1990 levels by 2040 and 68% by 2050. When planned measures are included, the projected reductions increase to 69% and 77%, respectively.

Although these projected emissions still fall short of the pathway towards climate neutrality, they are significantly lower than in previous assessments. For 2050, the projections show an additional reduction of more than 11 and 12 percentage points for the existing measures (WEM) and planned measures (WAM) scenarios respectively, reflecting an increased policy focus on long-term emission reductions.

As methodologies develop for calculating emissions and removals from the LULUCF sector, Member States continue to refine the LULUCF values in their past GHG inventories. In the past year, this resulted in lower historical net removals than were previously reported. More information is available in Box 1.1, Box 3.2 and in Section 2 of the Technical Background Report, which is published alongside this report.

Box 1.1

Continuous improvement of the GHG monitoring and reporting methodologies

Although still substantial, the -35.6% net reduction in GHG emissions within the ECL scope over 1990-2023 is less pronounced than the decrease reported in last year's *Trends and projections in Europe* report.

The main reason for this difference lies in significant revisions to emissions and removals from the LULUCF sector in this year's GHG inventory, resulting in lower net removals.

For example, LULUCF removals for 2018 in last year's report amounted to 256MtCO₂e, whereas in this year's report the value has been revised to 203MtCO₂e. This adjustment primarily reflects the incorporation of more accurate and up-to-date national forest inventories, which indicate that carbon stocks in forests are increasing more slowly than previously assumed. Consequently, the estimated carbon sink has been revised downwards.

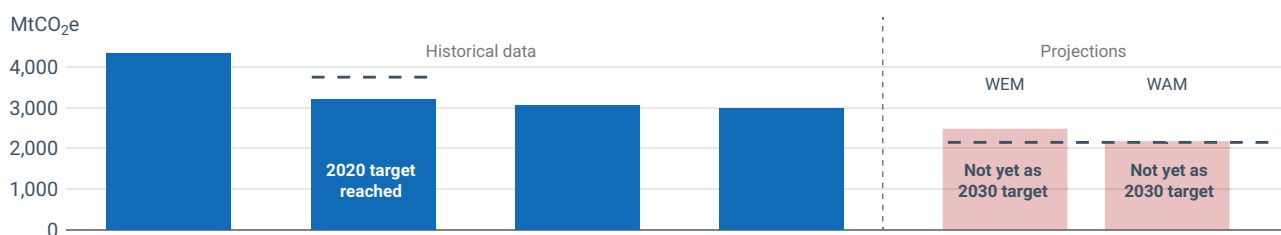
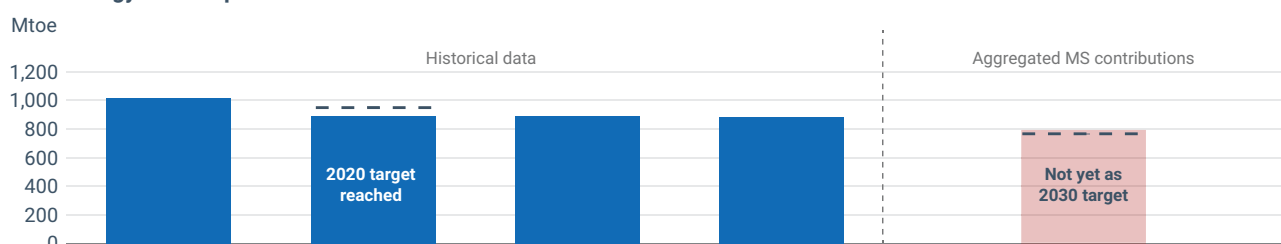
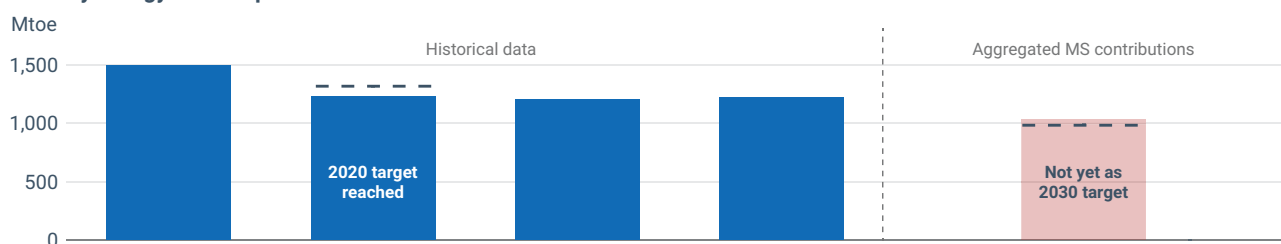
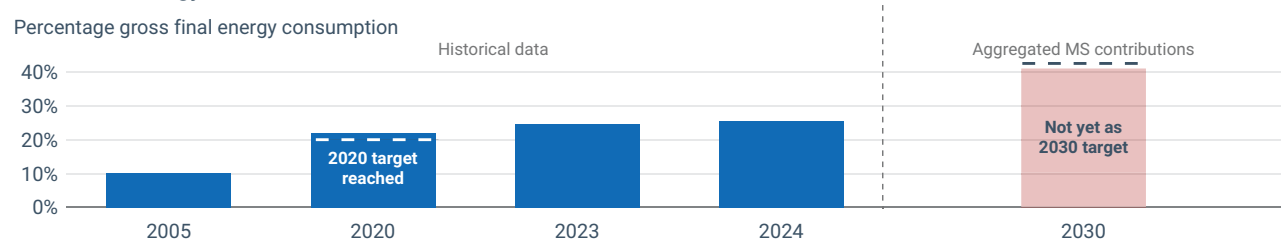
In the coming years, monitoring and reporting of LULUCF emissions will be further enhanced, notably by using granular geospatial data derived from earth observation and sampling methods.

1.2.2 Deployment of renewable energy and improvements in energy efficiency

Alongside the substantial GHG emission reductions already achieved, the EU continues to increase its use of renewable energy (Figure 1.2).

The EU-wide share of renewable energy in gross final energy consumption rose from 10.2% in 2005 to 24.6% in 2023. Based on the national contributions set out in the Member States' national energy and climate plans (NECPs), this share is expected to reach 41% by 2030, approaching the EU-wide target of 42.5% for that year.

In terms of energy efficiency, the EU's primary energy consumption in 2023 amounted to 1,209 million tonnes of oil equivalent (Mtoe), while final energy consumption stood at 894Mtoe. Both figures indicate that a significant gap remains to be bridged to meet the 2030 energy efficiency targets.

Figure 1.2 Progress towards achieving 2030 targets in the EU-27**Greenhouse gas emissions****Final energy consumption****Primary energy consumption****Renewable energy share**

--- Targets for 2020 and 2030

Notes: GHG emissions include those from the LULUCF sector and international transport, consistent with the scope of the ECL. The 2030 contributions for renewable energy, primary energy consumption and final energy consumption are drawn from the EC's impact assessment of the final updated national energy and climate plans (NECPs) submitted by Member States in 2024 and 2025. The assessment estimates that the combined renewable energy contribution of all Member States is estimated to reach a 41% renewable energy share in 2030. The combined contribution for final energy consumption amounts to 794Mtoe. The combined contribution for primary energy consumption amounts to 1,040Mtoe (EC, 2025f). The 2030 GHG emission reduction target, derived from the ECL, applies a net 55% reduction to the calculated 1990 baseline values. Under the ECL, the LULUCF contribution to the target is capped at a removal of 225Mt. If removals surpass this level in 2030, the result would be a slightly higher overall reduction than the 55% target.

Mtoe, million tonnes of oil equivalent.

MtCO₂e, million tonnes of CO₂ equivalent.

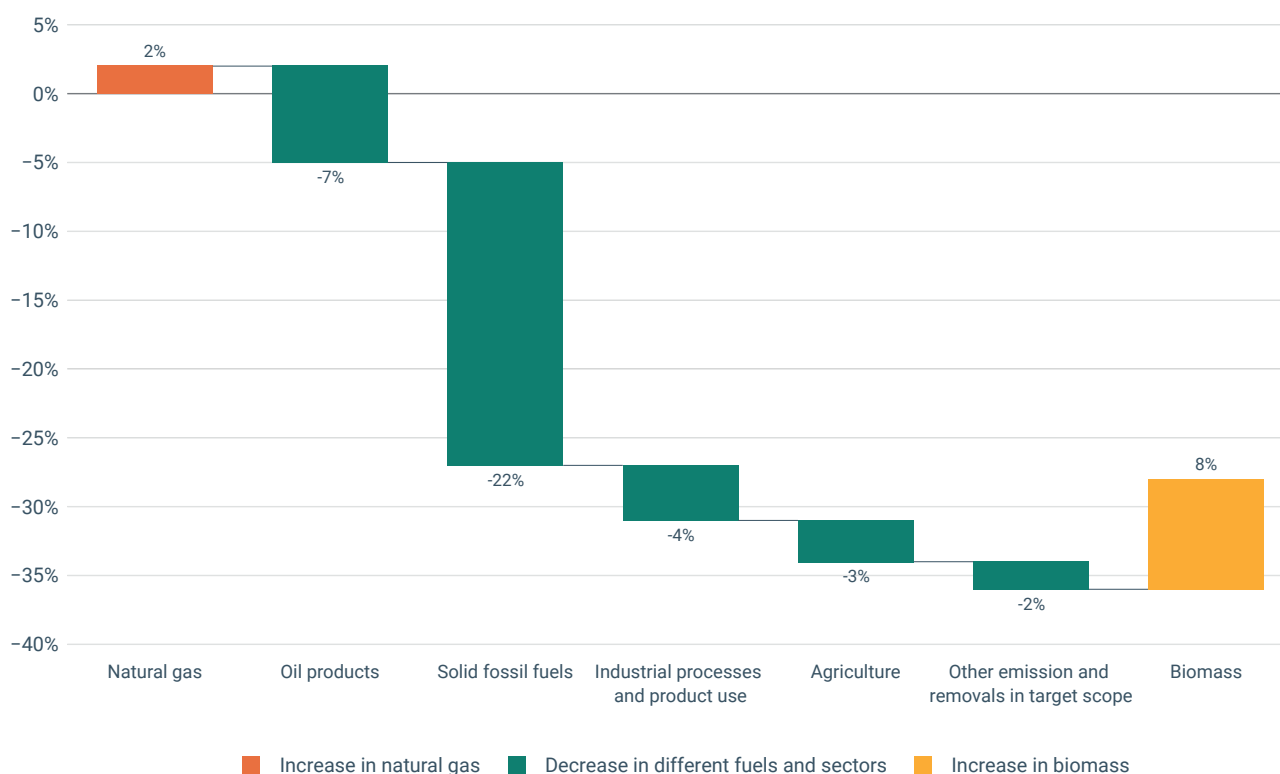
Sources: Author's compilation based on data from EEA (forthcoming, forthcomingb, forthcomingc), EU (2023c), Council of the European Union (2023); Eurostat (2025a, 2023); EC (2023); EC (2025b).

1.3 EU-wide developments in emissions and energy

1.3.1 What were the main drivers for the reductions in GHG since 1990?

Figure 1.3 Contributions of selected fuels and sectors to overall EU GHG emission reduction, 1990-2023

Percentage point change compared to total 1990 emissions (ECL scope)



Notes: The emission developments presented represent the reduction in total GHG emissions relative to 1990 within the ECL target scope and are linked to selected key drivers. For example, the reduction in GHG between 1990 and 2023 associated with solid fossil fuels contributed to a 22% decrease in total emissions. The emissions reductions linked to fossil fuels cover all energy-related emissions, including those from the energy supply, transport, industry and buildings sectors. CO₂ emissions from biomass, reported by Member States as memo items in their GHG inventories, are shown in parallel.

Source: Author's compilation based on data from EEA (2025d).

The combustion of fossil fuels for energy use remains the main driver of global climate change and this is also true for Europe.

A broad overview of GHG emissions sources show that, throughout 1990-2023, about three-quarters of total annual EU emissions were linked to fossil fuel combustion ⁽³⁾. Coal in particular, which accounted for over one-third of total emissions in 1990, recorded an almost 70% reduction by 2023, making it the largest single contributor to the overall reduction in GHG emissions.

Oil products, which were also responsible for over one third of emissions in 1990, continued to grow until 2008, followed by a steady decline, resulting in 2023 levels more than 20% lower than in 1990.

⁽³⁾ Similarly, over the same period of time about three quarters of the total emission reductions result from the decline of fossil fuel emissions.

Part of the reduction in coal and oil use was offset by the increased consumption of natural gas, which grew by 16% between 1990 and 2023.

With fossil fuels emissions on a stable decreasing trend, it becomes increasingly important reducing emissions from industrial processes, agriculture and other emission sources.

In addition to fossil fuels, biomass combustion has become a significant source of energy supply in the EU (dominant within renewable heat and present in the power mix). CO₂ emissions from combusting biomass for energy are reported as zero in the energy sector in GHG inventories, according to the IPCC guidelines, and excluded from national totals – because associated carbon (related to biomass growth and harvest) is accounted for in LULUCF sector. Countries (including EU Member States) still report the CO₂ from biomass combustion as a 'memo' item. These reported data show that biomass use has increased substantially over the past decades: memo-item biomass emissions in 2023 were more than 2.5 times higher than in 1990.

EU policies, such as the Renewable Energy Directive (RED), promote sustainable biomass sourcing, enhanced emissions monitoring and stricter land use regulations to ensure that biomass use does not compromise environmental integrity. Only biomass resources that comply with EU sustainability criteria can be accounted towards national renewable energy targets.

GHG emissions not related to energy have also declined significantly in the EU. For example, nitrous oxide (N₂O) and methane (CH₄) have fallen due to reduced mining activity, a smaller agricultural livestock population (*) and lower emissions from managed waste disposal and the production of adipic and nitric acid (EEA, 2023).

Within industrial processes, fluorinated gases represent nearly one quarter of non-CO₂ emissions. While total GHG emissions in the industrial sector have fallen by 41% since 1990, emissions from fluorinated gases almost doubled by 2014 and remained 27% above 1990 levels in 2023.

1.3.2 Main EU policy supporting GHG reductions towards the 2030 target

The EU has implemented a comprehensive framework of policy measures to ensure that its climate objectives are achieved. In pursuit of the 2030 climate target, the Fit for 55 package has strengthened existing instruments, ensuring that GHG emissions are addressed through one of the following key policy tools.

EU ETS

The EU ETS (EU, 2023b) covers GHG emissions from stationary installations in the power sector and large industrial plants, which together accounted for 33% of total EU GHG emissions in 2023.

Since 2012, the ETS has also included CO₂ emissions from aviation. Maritime CO₂ emissions have been included since 2024 (CH₄ and N₂O emissions will be included from 2026).

From 2027, a new and separate system (ETS2) will cover CO₂ emissions from fuel combustion in buildings, road transport and small industries.

(*) Overall, non-CO₂ GHG emissions from agriculture declined by 25% between 1990 and 2023.

The EU ETS operates as a cap-and-trade system. The cap limits the total volume of GHGs that can be emitted by covered operators. Within the cap, allowances can be traded among operators as needed.

Following the 2023 revision of the ETS Directive (EU, 2023c), the cap was tightened to deliver a 62% emission reduction by 2030 compared with 2005 levels. Between 2005 and 2024, GHG emissions within ETS sectors (stationary installations) have fallen by 51%. In 2023, emissions decreased substantially, by nearly 17% for stationary installations compared to 2022. Sustained reductions in recent years place the EU on track to meet the 62% target for 2030, as confirmed by Member States' projections.

A sectoral analysis of the ETS is provided in Chapter 2 of this report.

ESR

National GHG reduction targets are governed by the ESR (EU, 2023f), which covers transport, buildings, agriculture and waste, as well as energy and industry emissions outside the current ETS. These ESR sectors represent around 66% of total EU GHG emissions.

In addition to setting binding national 2030 targets, the ESR defines annual emission limits for 2021-2030. The latest revision establishes a 40% emission reduction objective by 2030 compared with 2005, translated into Member State targets and annual trajectories.

In 2023, ESR emissions were 20% below 2005 baseline levels and below the 2023 aggregated emission limit, consistent with the trajectory towards 2030.

Although preliminary 2024 estimates show little change compared with 2023, recent projections that include additional measures suggest a 38% reduction relative to 2005, narrowing the gap to the 2030 ESR target to just two percentage points.

LULUCF regulation

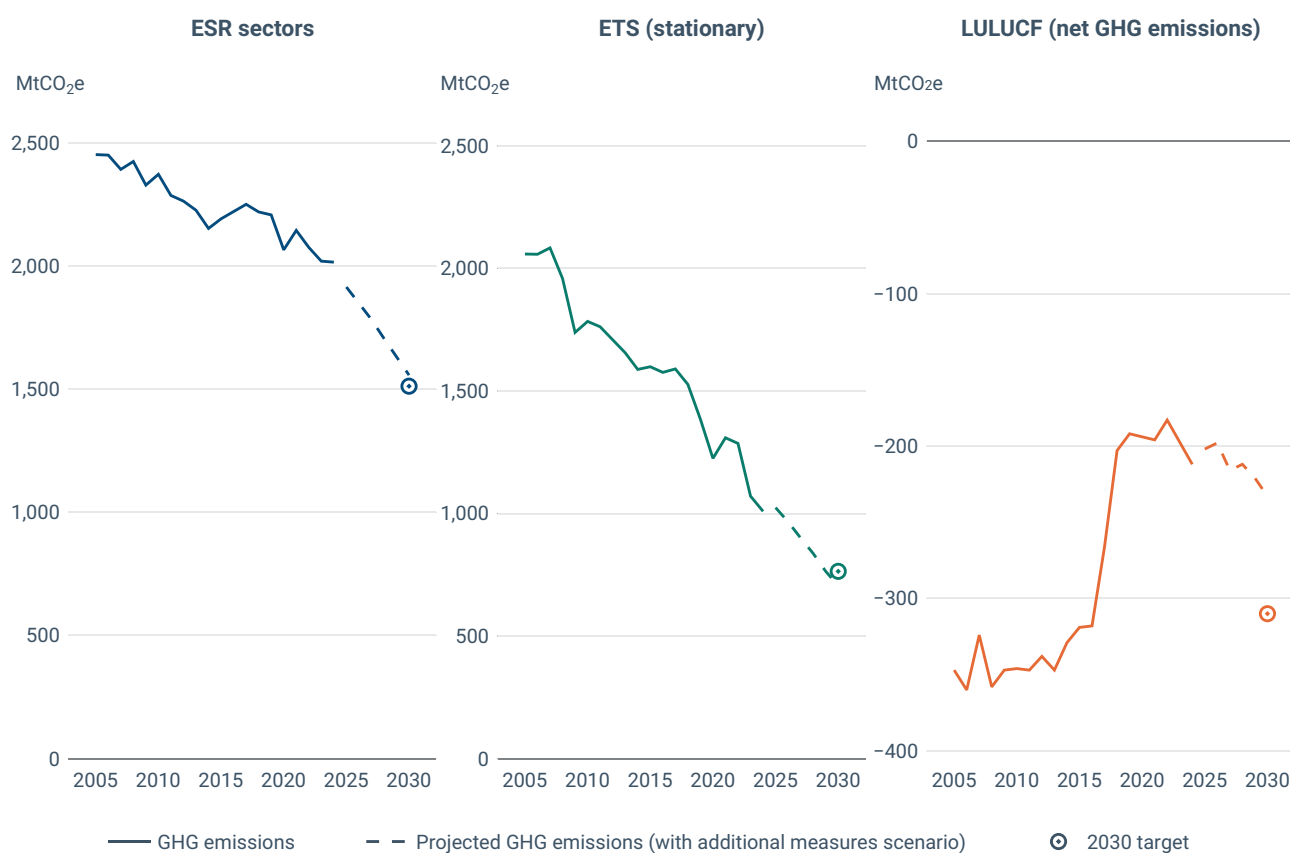
GHG emissions and removals from the LULUCF sector are covered by the regulation on GHG emissions and removals from LULUCF (EU, 2023e). Together, these activities act as a net carbon sink, removing 198MtCO₂e from the atmosphere in 2023, according to GHG inventories.

However, the EU's LULUCF carbon sink has declined significantly: during 2014-2023, the average annual sink was over 30% smaller than in the previous decade. Consequently, the relative contribution of LULUCF to offsetting emissions from other sectors has fallen.

In 2013, LULUCF removals represented almost 10% of total GHG emissions, compared with just over 6% in 2023. Preliminary 2024 estimates indicate a small improvement, with 212MtCO₂e removed, though this remains subject to confirmation once final data are available, due to year-on-year variability.

Member State projections suggest a stabilisation at current levels, highlighting the need for stronger additional action to achieve the EU's 2030 LULUCF target.

Figure 1.4 Breakdown of GHG emission trends in the sectors covered by ESR, EU ETS and LULUCF



Notes: The 2030 targets are derived from the legally specified targets outlined in the ETS Directive (EU, 2023c), the ESR (EU, 2023f) and the LULUCF Regulation (EU, 2023e). For ETS, the comprehensive ETS cap reduction target of 62% is specifically applied to stationary installations. The data for the 2024 values are from EEA (EEA, forthcoming), while the 2025-2030 data refer to the aggregated GHG emission projections submitted by Member States in 2025, taking planned additional measures into account ('WAM-scenario').

Source: Author's compilation based on data from EEA (forthcoming, 2025i).

1.4 EU-wide developments in renewable energy sources

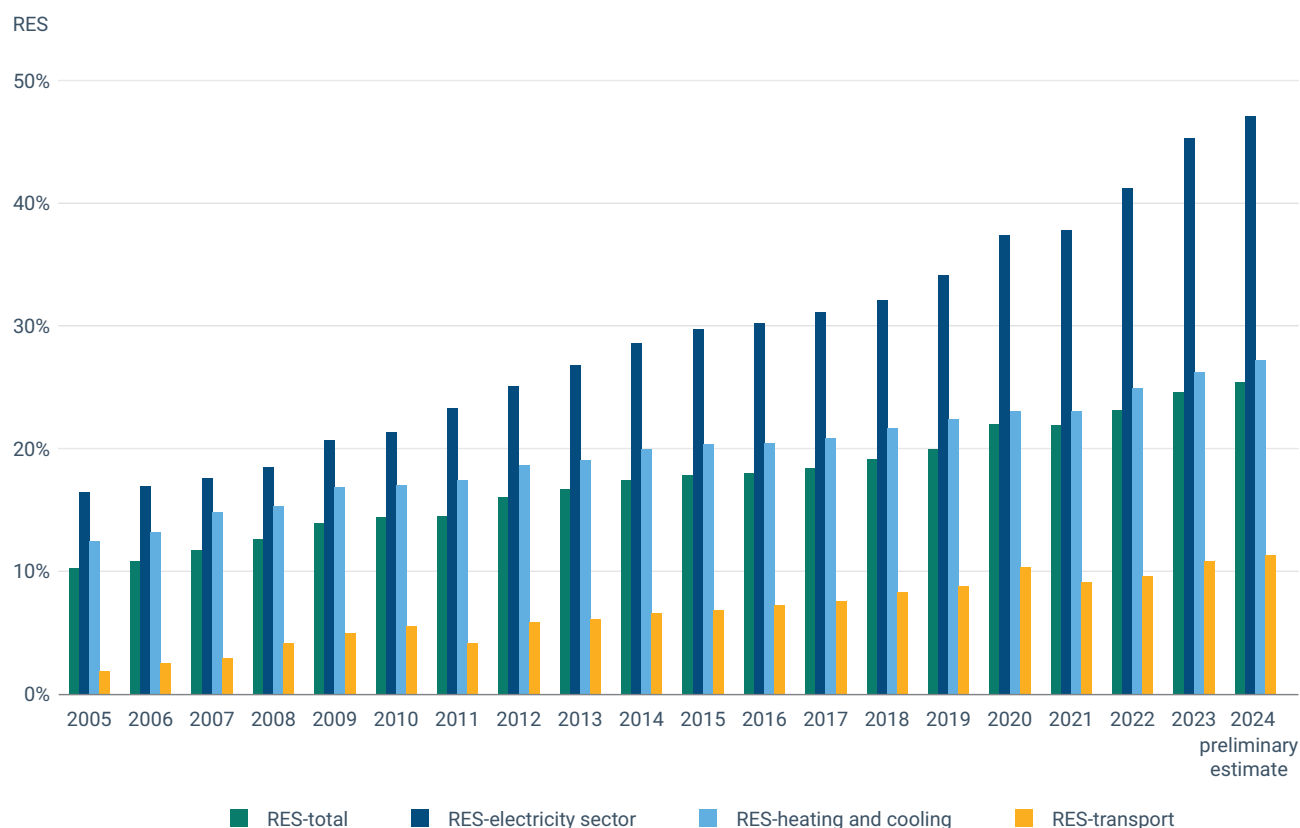
The EU's renewable energy target for 2030 is for the share of renewable sources in gross final energy consumption to reach at least 42.5%, with an aspirational level of 45% (EU, 2023d). Each Member State contributes to this collective target through a renewable energy share (RES) contribution, communicated in its national energy and climate plan (NECP) for the 2021-2030 period.

In May 2025, the EC assessed the final updated NECPs of 24 Member States that had submitted their plans by that date ⁽⁵⁾ and estimated that their combined RES contributions would deliver a 41% EU-wide renewable energy share in 2030 (EC, 2025).

The EU-wide total renewable energy share in gross final energy consumption (RES-Total) increased from 10.2% in 2005 to 24.6% in 2023 (see Figure 1.5), leaving a 17.9 percentage point gap to the binding minimum 2030 target.

⁽⁵⁾ Belgium, Estonia and Poland had not submitted a final updated NECP by then. For its assessment, the EC used the draft NECP information for Belgium, while Estonia and Poland provided specific additional information on their national contributions.

Figure 1.5 Renewable energy shares (RES) in gross final energy consumption, 2005-2024



Note: This figure shows the share of renewable energy used in the EU-27 across the electricity, heating and cooling, transportation and overall energy use sectors. These percentages are presented as a share of the gross final energy consumption across the different categories, with the 2024 values referring to estimates.

Sources: Author's compilation based on data from Eurostat (2025g), EEA (forthcoming).

Looking at annual trends, between 2005 and 2023, the average annual linear growth was 0.8 percentage points, while the past five years showed a faster average growth rate of 1.1 percentage points per year. To reach the 2030 target, this pace will need to more than double — averaging 2.6 percentage points per year to align with the target trajectory.

Preliminary estimates for 2024 indicate a RES-Total share of 25.4%, representing a growth of 0.9 percentage points compared with 2023.

Although electricity is not the largest sector when it comes to total energy consumption compared with heating and cooling or transport, it remains the sector in which renewables have progressed most. The electricity sector accounted for the largest share of renewables (RES-E), rising from 16.4% in 2005 to 45.3% in 2023, with an average annual growth rate of 1.6 percentage points. Preliminary 2024 estimates place the electricity sector at 47.1%.

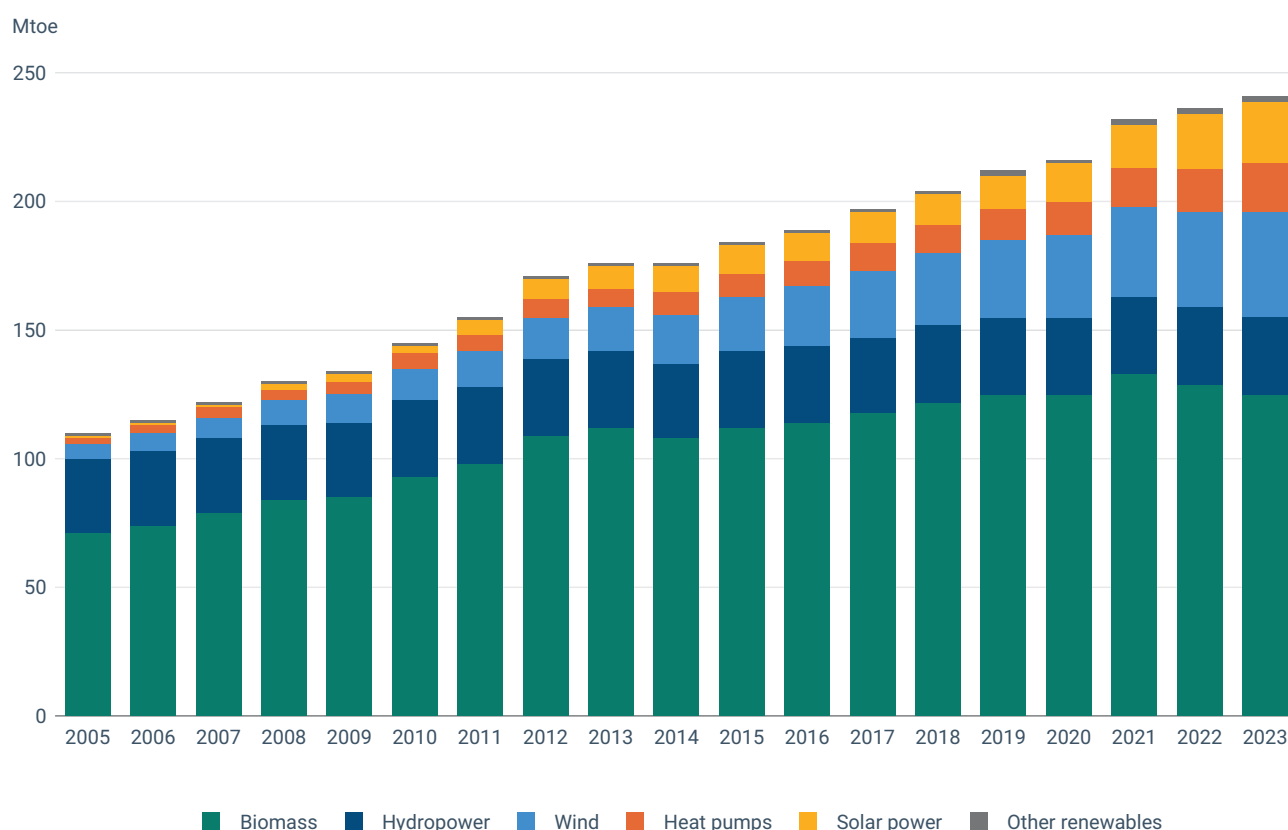
The renewable energy share in heating and cooling (RES-HC) grew from 12.4% in 2005 to 26.2% in 2023, averaging 0.8 percentage points per year, mirroring the trend for total RES. Preliminary data for 2024 suggest RES-HC shares reached 27.2%.

In transport, renewable energy shares (RES-T) increased from 1.8% in 2005 to 10.8% in 2023, an average annual rise of 0.5 percentage points. Preliminary estimates for 2024 indicate a RES-T share of 11.3%.

In absolute terms, total gross final renewable energy consumption more than doubled between 2005 and 2023 (Figure 1.6).

The largest growth during that period was recorded for solar power, which increased 27-fold, followed by heat pumps (eight-fold) and wind power (seven-fold). In 2005, none of these sources accounted for more than 5% of the EU RES, while biomass already represented 64%. By 2023, biomass accounted for 52% of renewable energy consumption, while the share of wind rose from 5% in 2005 to 17% in 2023, making wind the second-largest source of renewable energy in the EU. Solar power and heat pumps represented 10% and 8%, respectively, of the EU's gross final renewable energy consumption in 2023. Although biomass consumption declined slightly over the past two years, this reduction has been more than offset by increases in wind and solar generation.

Figure 1.6 Renewable gross final energy consumption in the EU-27 by technology



Notes: In the graph, the 'biomass' category includes solid biomass, biogas, bioliquids, biodiesel, biofuels, biogasoline and renewable municipal waste. Please consult the technical background document published alongside this report for more information on definitions and uses of different forms of bioenergy. 'Solar' refers to concentrated solar power, solar photovoltaic and solar thermal energy. 'Hydropower' covers normalised hydropower, excluding pumped storage. 'Wind' refers to normalised onshore and offshore wind energy. 'Heat pumps' represents renewable energy generated from heat pumps. 'Other renewables' includes tidal, wave and ocean energy, as well as geothermal electricity. All categories were aggregated from the SHARES Details data files, indicating net inland consumption, considering imports and exports.

Mtoe, million tonnes of oil equivalent.

Sources: Author's compilation based on data from EEA (2025d), based on Eurostat (2025j).

Box 1.2

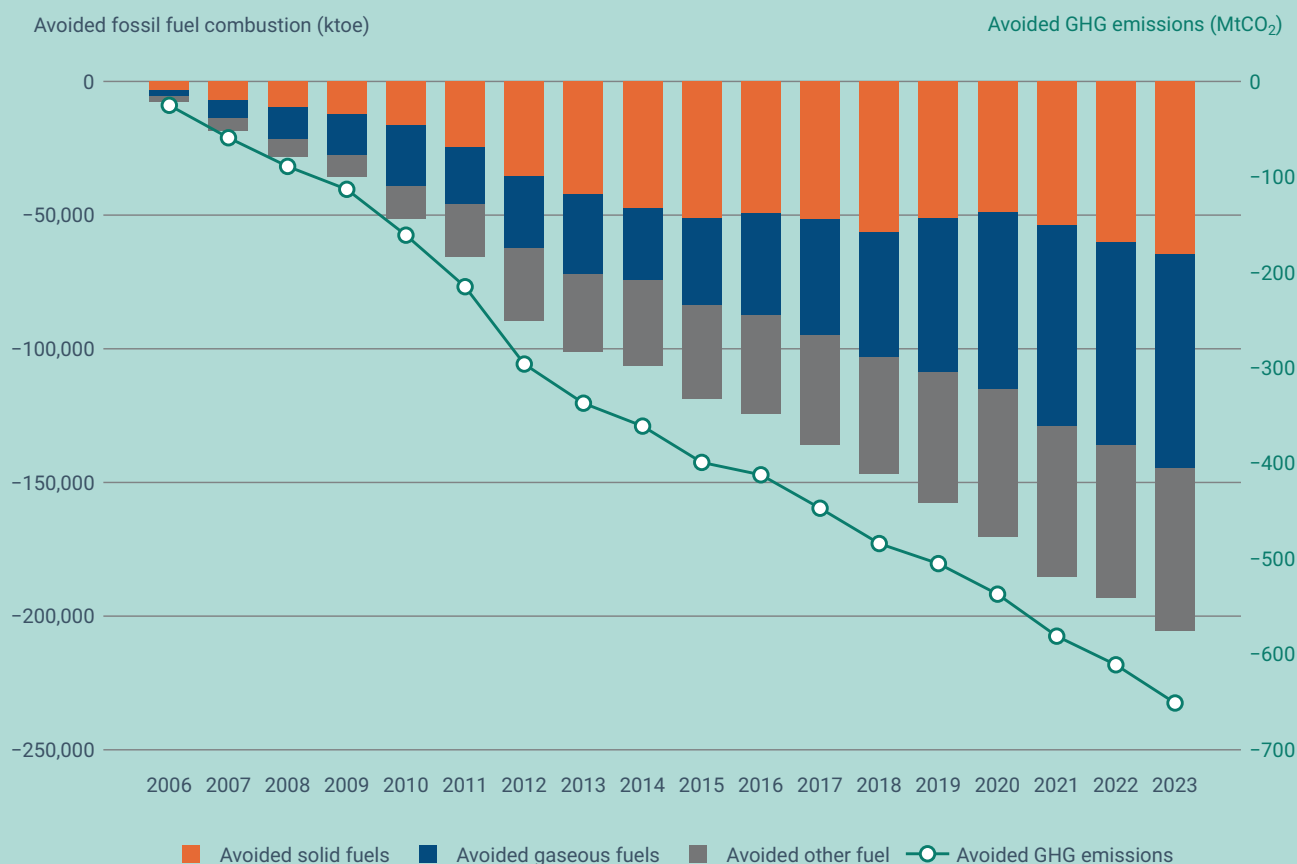
Impact of renewable energy deployment on avoided GHG emissions and avoided fossil fuel costs

In 2023, the use of renewable energy avoided the consumption of 205Mtoe of fossil fuels, mainly solid and gaseous fuels (see Figure 1.7). This corresponds to a reduction of 650MtCO₂ in total yearly GHG emissions, predominantly within the scope of the EU ETS. Without this deployment of renewable energy, ETS emissions from stationary installations would be almost 50% higher.

At the same time, the expansion of renewable energy and the reduction in fossil fuel use also lower energy costs and reduce the EU's dependence on fuel exporting countries. As part of the Affordable Energy Plan (EC, 2025e), published in February 2025, the EC estimated that, without the energy transition, the EU's fossil fuel import bill in 2025 would be EUR 45 billion higher than in 2019, representing approximately 0.25% of EU GDP. With the full implementation of the action plan, the EU's fossil fuel import bill is projected to decrease each year, reaching annual savings of EUR 130 billion by 2030 (0.65% of the GDP) and EUR 260 billion by 2040.

These data and projections demonstrate that climate action can go hand in hand with other key policy objectives such as reducing the EU's dependency on imported energy and lowering recurring energy costs (EEA, 2024e).

Figure 1.7 Effects of the use of renewable energy on avoiding fuel consumption and GHG emissions



Notes: Ktoe, kilo tonnes of oil equivalent.
MtCO₂e, million tonnes of CO₂ equivalent..

Sources: EEA (2024e).

1.5 EU-wide evolutions in energy efficiency

The revised Energy Efficiency Directive (EED) (EU/2023/1791), which entered into force in October 2023, establishes a strengthened framework to achieve a binding 11.7% reduction in EU energy consumption by 2030, compared with the 2020 reference scenario projections.

The directive sets the following 2030 targets: (1) a binding target for final energy consumption of no more than 763Mtoe and (2) an indicative target for primary energy consumption of no more than 992.5Mtoe. These targets require a significant acceleration of energy efficiency efforts and a systemic shift toward a more sustainable, energy-conscious economy.

To support achievement of the 2030 goals, the EED establishes a comprehensive package of policy measures promoting energy savings across all sectors, with a particular emphasis on the public sector, which is expected to lead by example.

Key instruments include annual energy savings for Member States, averaging 1.49% per year from 2024 onwards, mandatory energy renovations of public buildings and the application of the Energy Efficiency First principle in all planning and investment decisions. The directive also introduces a social obligation requiring Member States to prioritise energy efficiency measures that alleviate energy poverty, particularly among vulnerable consumers and low-income households.

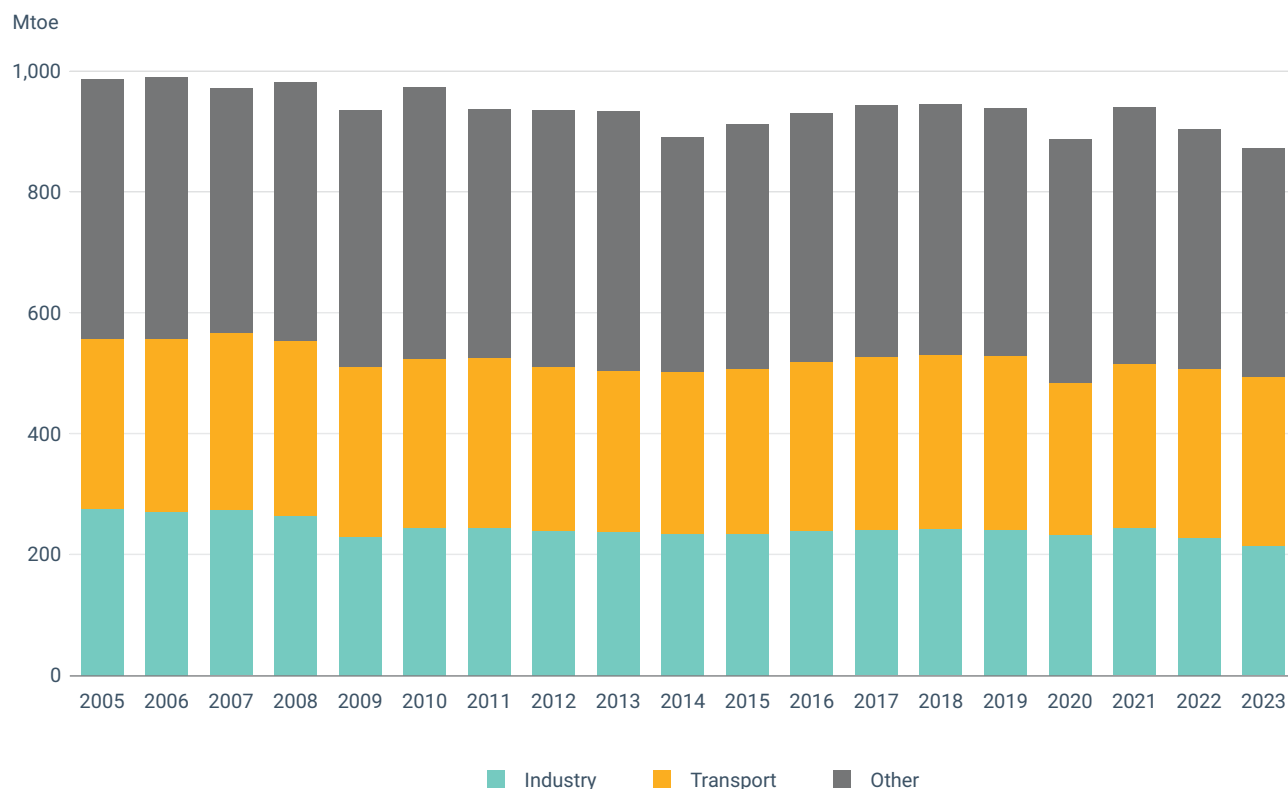
Member States are required to collectively achieve the EU-wide targets by updating their NECPs with enhanced national contributions. The final NECPs were due by 30 June 2024, ensuring alignment with the 2030 targets. According to the EC's May 2025 assessment of the submitted NECPs, the aggregated national contributions for 2030 would result in EU final energy consumption of 794Mtoe in 2030, which is 4% (31.1Mtoe) above the target. For primary energy consumption, the combined national contributions are almost 5% (47.3Mtoe) higher than the EU-wide ambition of 992Mtoe for 2030.

The historical evolution of energy consumption (Figure 1.8) shows a modest reduction in final energy consumption, with an average annual decline of 0.6% since 2005. In 2023, this corresponded to a consumption level of 894Mtoe – still more than 17% above the 2030 target.

During the five-year period 2018-2023, the average annual decline slowed to just 0.2% per year. The sectoral distribution of final energy consumption has remained relatively stable over recent decades. In 2023, industry accounted for approximately 25%, transport for just over one-third and other sectors for the remaining 43% of total final energy consumption.

In recent years, external shocks, such as the COVID-19 pandemic and the energy crisis, have significantly influenced energy consumption. In 2020, final energy consumption dropped by 8% compared with the previous year, primarily due to declines in industry and transport. This was followed by a 6.3% rebound in 2021, a 2.8% decline in 2022 and a 3% decrease in 2023, partly driven by the energy crisis.

By sector, industry consumption fell by 22% in 2023 compared with 2005, while other sectors declined by 11.8%. The transport sector remained relatively stable, with a slight 0.8% decline over the same period. Preliminary estimates for 2024 suggest a further 0.9% annual decrease in total final energy consumption, representing a 12.9% reduction compared with 2005.

Figure 1.8 Final energy consumption per sector in the EU-27, 2005-2023

Notes: This figure illustrates the evolution of final energy consumption in the EU-27 by end-sector. The 'Other' category comprises commercial and public services, households, agriculture and forestry, fishing and other sectors. Data for 2005-2023 is obtained from Eurostat, based on the definition laid out in Article 2 of the revised EED.

Mtoe, million tonnes of oil equivalent.

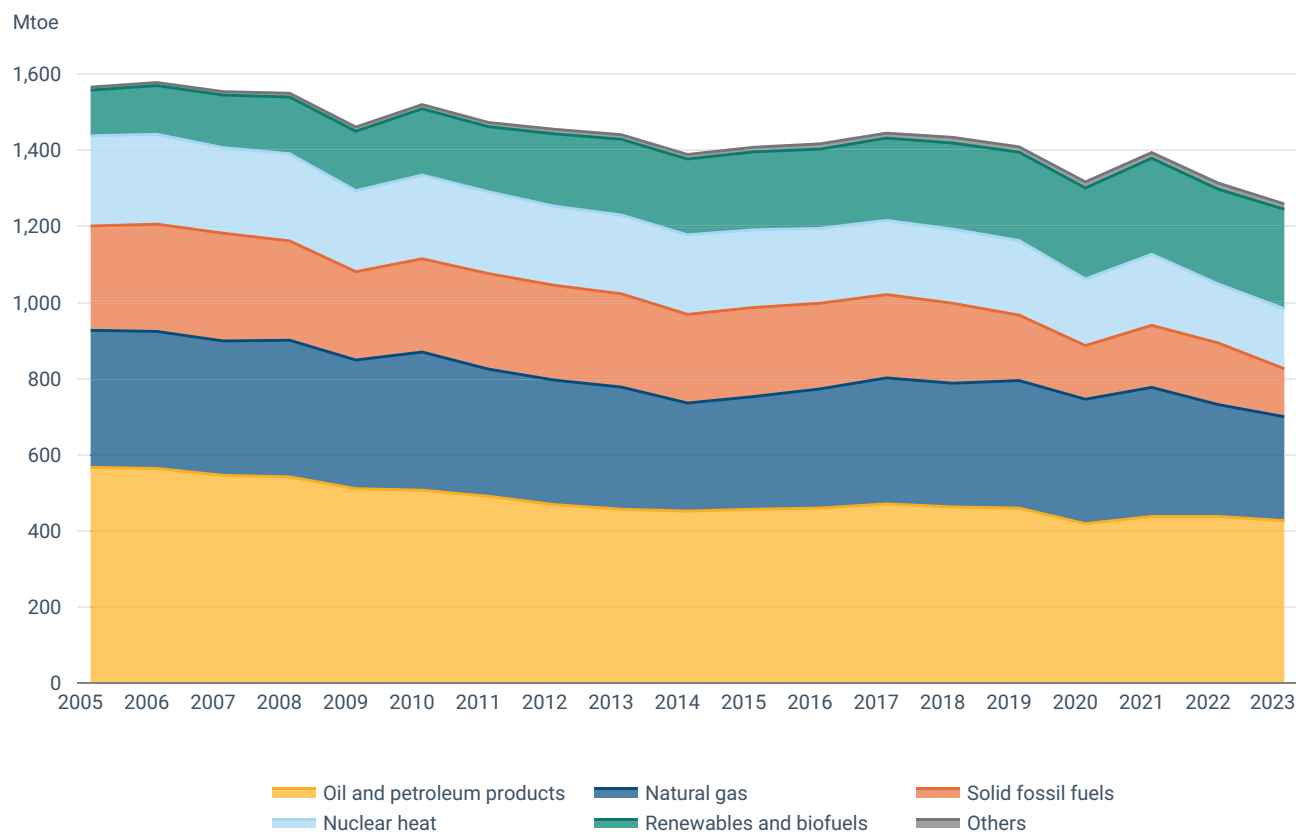
Sources: Author's compilation based on data from Eurostat (2025a).

Primary energy consumption has followed a similar but more pronounced downward trend. Since 2005, it has decreased by an average of 1.0% per year, with 2024 estimates showing an 18.3% reduction compared with 2005. This trend has been strongly influenced by changes in the fuel mix.

In the absence of disaggregated data on primary energy consumption by source, total energy supply ^(e) is used as an indicator of the long-term trend. As illustrated in Figure 1.9, the share of renewables in total energy supply has grown substantially, becoming the third-largest energy source in the EU since 2018, after oil and natural gas. The gap between gas and renewables had narrowed to almost negligible by 2023.

Data for 2023 show notable year-on-year reductions in the consumption of solid fossil fuels (-23%), other sources (-10%), gas (-7.3%) and oil (-2.5%). In contrast, renewables (+4.5%) and to a lesser extent nuclear heat (+1.6%), contributed to an overall increase in total energy supply.

^(e) Total energy supply represents the overall quantity of energy available for all activities within a country's territory. It covers energy transformation, energy sector operations, transmission and distribution losses and final energy consumption. Both total energy supply and primary energy consumption exclude international aviation and maritime bunkers. The key distinction between the two indicators is that non-energy uses of fuels (such as feedstocks in the chemical industry) are included in total energy supply but excluded from primary energy consumption.

Figure 1.9 Total energy supply per source and in EU-27, 2005-2023

Notes: This figure illustrates the evolution of total energy supply in the EU-27 since 2005, categorised by energy source. The 'Other' category is composed of non-renewable waste and electricity as an energy source.

Mtoe, million tonnes of oil equivalent.

Sources: Author's compilation based on data from Eurostat (2025a).

To reach the 2030 target, the pace of energy savings must accelerate, requiring further reductions of 131Mtoe in final energy consumption and 216Mtoe in primary energy consumption.

Between 2005 and 2023, final energy consumption decreased by an average of 7Mtoe per year, with the annual pace intensifying to 16Mtoe during 2019-2023. To achieve the binding 2030 target, the annual reduction will need to accelerate by 16% compared with 2019-2023.

Primary energy consumption fell by an average of 16Mtoe per year between 2005 and 2023, increasing to 34Mtoe annually during 2019-2023. Maintaining this faster pace through to 2030 will be necessary to achieve the indicative EU-wide target for primary energy consumption.



2 Trends and projections of greenhouse gas emissions in economic sectors

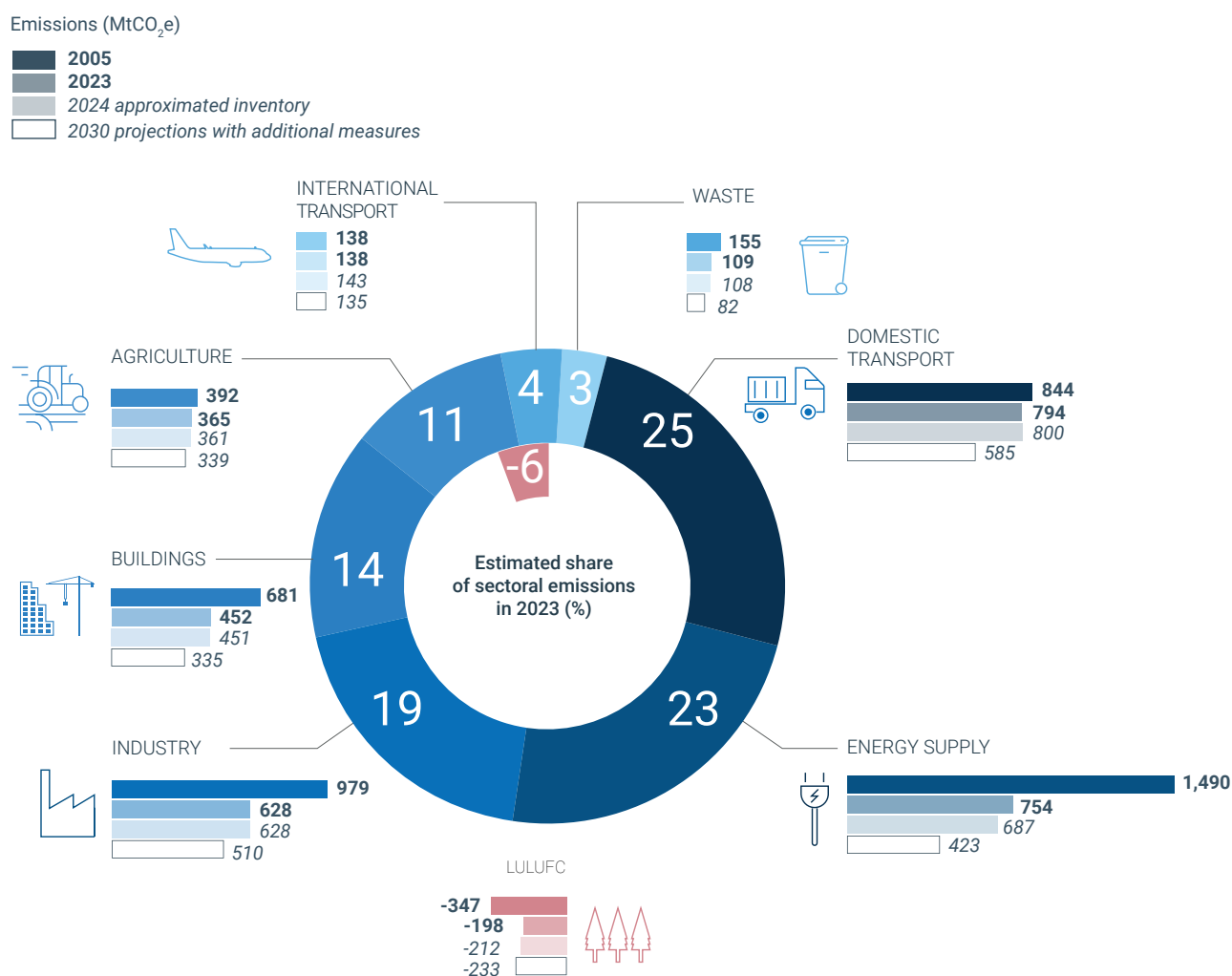
Key messages

- Over the past five years, emission reductions have been particularly strong in the energy supply sector, with an average annual decrease of 6.3%. Since 2023, domestic transport has overtaken energy supply to become Europe's largest emitting sector, accounting for 24.5% of total EU GHG emissions. Domestic transport emissions peaked in 2007, but mitigation progress since then has been slow and variable; preliminary 2024 data even indicate a slight year-on-year increase.
- Following robust reductions in 2022 and 2023, preliminary data for 2024 show that emissions in both industry and the building sector have stabilised, signalling that further mitigation efforts will be required to meet the EU's climate targets.
- Agricultural emissions have declined at a slower pace than those in other sectors, with an average annual reduction of 1.1% over the past five years and preliminary data for 2024 indicating a year-on-year reduction of 1.2%. The slower progress in agriculture is expected to increase its relative share of total GHG emissions, currently around 11%.
- In contrast to other sectors, net GHG emissions from LULUCF have trended in the wrong direction over the past decade, leaving the EU off track to meet its 2030 LULUCF target. However, 2023 and preliminary 2024 estimates suggest a reversal of this trend, with the EU carbon sink increasing by 15Mt (8.3%) and 13Mt (6.8%), respectively. Sustaining this positive turnaround will require stronger LULUCF mitigation policies and measures.
- The gradual phase-out of free allowances for industrial installations under the ETS, combined with the introduction of a second ETS (covering buildings and transport) in 2027, is expected to provide a strong economic incentive for a steeper decline in emissions in covered sectors. In mid-2026, the EC is also expected to propose legislation on international aviation emissions, which have shown a long-term upward trend, except in 2020 during the COVID-19 pandemic.

The aggregated figures presented in Chapter 1 mask significant sectoral differences in progress towards reducing GHG emissions, improving energy efficiency and increasing renewable energy uptake. Accordingly, this section analyses sector-specific trends in direct and end-user GHG emissions and examines the sectoral trends and projections within the scope of the EU emissions trading systems.

2.1 Trends and projections of GHG emissions by sector

Figure 2.1 Sectoral trends and progress towards achieving the 2030 GHG emission target



Note: MtCO₂e, million tonnes carbon dioxide equivalent.

Sources: Author's compilation based on data from EEA (forthcoming, 2025b, 2025i).

As shown in Figure 2.1, total GHG emissions in the EU can be attributed to several sectors — most notably transport, energy supply, industry, buildings and agriculture. While the energy supply sector was the largest contributor to total GHG emissions for much of the past few decades, transport overtook this role in 2023. The LULUCF sector, which covers GHG emissions and removals associated with land activities and forests, is the only sector that acts as a net carbon sink in the EU, removing around 6% of total GHG in 2023.

2.1.1 Transport

The transport sector is a major source of GHG emissions in the EU. Since 2023, the domestic transport sector – which covers transport-related GHG emissions generated within EU territory – has surpassed the energy supply sector to become the largest emitting sector, accounting for 24.5% of total EU GHG emissions in target scope.

When international transport emissions – linked to transboundary aviation and maritime activities as accounted under the EU target scope – are included, the transport share rises to 28.8%.

GHG emissions from the transport sector peaked in 2007, followed by a modest downward trend. In 2023, domestic transport emissions were 17.9% higher than 1990 levels, but 5.9% lower than in 2005. Over the past five years, average annual reductions have been around 0.6%.

These overall trends are largely driven by road transport, which accounts for almost three-quarters of total transport emissions. While both passenger and freight activity have continued to increase – interrupted only by the COVID-19 crisis – the GHG intensity per kilometre travelled has improved significantly.

According to the EEA indicator on new registrations of electric cars in Europe (EEA, 2024f), in 2023 nearly one in four new cars sold in the EU was an EV. In some countries, EV sales doubled (Belgium and Cyprus) or almost doubled (Portugal, Estonia and Greece) within a single year, demonstrating the accelerating pace of transformation in new car registrations. However, despite this substantial growth in new sales, in 2023 only 3% of the total EU passenger car fleet was battery electric or plug-in hybrid, indicating considerable potential for further electrification of road transport.

Beyond domestic transport, GHG emissions from international aviation have continued to rise, rebounding rapidly after the temporary decline during the COVID-19 pandemic. In contrast, emissions from international navigation have declined gradually since 2007.

This modest overall reduction in transport emissions indicates that additional policies and strategies will be required to accelerate the decarbonisation of the transport sector. The new ETS2, which introduces a carbon price for road transport, is expected to make EVs more cost-competitive relative to fossil fuel vehicles, potentially further boosting EV adoption. However, complementary incentive programmes and compensation mechanisms will be needed to prevent an unjust transition across Member States. For example, measures could include managing mobility demand, promoting active and collective transport modes and improving access to local services (EEA, 2024h).

When compared with the indicative 2030 trajectory of the EC's assessment, current domestic transport emissions still show a substantial gap. Bridging this gap will require average annual reductions of about four percentage points until 2030. Aggregated projections reported by Member States indicate that this gap can be closed if planned policies and measures are implemented swiftly and effectively.

Preliminary figures for 2024 suggest a slowdown in transport sector decarbonisation, with an estimated 0.7% increase in domestic transport emissions compared with 2023.

Notably, the share of EVs among new registrations in the EU declined from 22.5% in 2023 to 20.9% in 2024. The 6% year-on-year decrease in EVs sales resulted in a higher carbon intensity of newly registered cars compared with the level that would have been achieved if the 2030 share of EVs had been maintained.

2.1.2 Energy supply sector

Europe's substantial reduction in fossil fuel use and the expansion of renewable energy production are most evident in the energy supply sector, which covers emissions from electricity generation, heat production and refineries. Emissions from this sector have more than halved compared with 1990 levels, with more than 90% of the reduction achieved since 2005. Over the past five years, the average annual exceeded 6%, including a 18.5% year-on-year decline in 2023.

This remarkable progress has been fuelled by a major shift in electricity generation. While in 2005 most EU electricity production came from coal, by 2023 renewable energy had become the largest contributor, accounting for 45.3% of total generation, while the share of fossil fuels fell to 32% (EC, 2024e).

Without this rapid expansion of renewable electricity since 2005, emissions from the energy supply sectors as a whole would have been almost twice as high in 2023 (EEA, 2024g). This transformation is reflected in the sharp decline in GHG intensity: producing one kilowatt hour (kWh) of electricity in 2023 emitted, on average, 19% less CO₂ than in 2022, 35% less than a decade ago and almost 60% less than in 1990 (EEA, 2025f).

The decarbonisation of heating systems has progressed more slowly than that of the electricity system, yet substantial changes have occurred over the past two decades – notably a marked reduction in fossil fuel use and a significant increase in biomass (EEA, 2025j). To reach the EC's indicative 2030 emission reduction trajectory for this sector, it will be essential to maintain the current downward trend. The combined projected emissions of the aggregated Member State projections indicate that the target emission level is within reach and might even be exceeded.

Preliminary 2024 figures confirm further progress, with the renewable energy share in electricity generation increasing to 46.9% and a year-on-year reduction of 8.9% in power sector emissions compared with 2023.

2.1.3 Buildings sector

The buildings sector, consisting of both residential and commercial buildings, accounted for 14% of total EU GHG emissions in 2023 ⁽⁷⁾, with the majority linked to space heating and cooling.

Emissions from the buildings sector have decreased by 38.6% since 1990, with most reductions occurring after 2005. Over the past five years, emissions fell by an average of 3.3% annually, including a 6.7% year-on-year reduction in 2023.

Because all building sector emissions are energy related, final energy consumption is a key explanatory factor. Between 1990 and 2010, final energy consumption in the residential and services sectors gradually increased to 25% above 1990 levels.

⁽⁷⁾ All figures in this section exclude indirect emissions from the production of electricity used in buildings (such as the electricity consumed by water heaters, lighting and electrical devices).

Since then, consumption has steadily declined, with 2023 energy use 17% lower than in 2010 (Eurostat, 2025k).

A detailed analysis by the JRC attributes the decline in residential energy use since 2010 mainly to improved energy intensity (less energy used per unit of gross value added) and milder winters — factors that offset upward pressures from population growth and rising income levels (JRC, 2024b). In addition to efficiency gains, the reduction in GHG emissions also reflects a shift in the fuel mix towards cleaner energy sources.

The EC's indicative 2030 trajectory for this sector assumes an emission reduction of more than 60% between 2005 and 2030. In 2023, emissions from the buildings sector were 33.6% below 2005 levels, while aggregated Member State projections suggest a 50.7% reduction by 2030. Both figures underscore the need for stronger incentives to accelerate emission reductions in the buildings sector, focusing on deep renovations, the wider deployment of heat pumps and the implementation of the ETS2 as key policy measures.

Preliminary 2024 figures indicate minimal further reductions of 0.3% compared with 2023.

2.1.4 Industry

GHG emissions from industry include both direct energy-related emissions — such as those from steam production for industrial use — and process-related emissions that are inherent to specific industrial activities.

Together, the industrial sector accounts for 19% of total GHG emissions in the EU. In 2023, the sector achieved a 46.4% reduction in emissions compared with 1990, with two-thirds of this reduction occurring after 2005. Over the period 2018-2023, the sector recorded an average annual reduction of 29Mt — equivalent to a yearly decrease of around 3.8%.

The near halving of industrial GHG emissions since 1990 occurred alongside a more than 60% increase in gross value added (GVA) for the sector as a whole, demonstrating the decoupling of emissions from economic growth. The progress can be largely attributed to improvements in energy efficiency — generating more output per unit of energy input — as well as a shift in the energy mix away from solid fossil fuels and reductions in specific process emissions, such as N₂O abatement in ammonia and nitric acid production.

While current technologies — incentivised by policy instruments such as the EU ETS and the Innovation Fund (financed by the EU ETS) — have led to a steady reduction in GHG intensity, achieving climate neutrality will require deep decarbonisation pathways for industry.

These include:

- greater electrification of production processes;
- a shift towards a more circular economy;
- the use of low-carbon fuels such as renewable hydrogen;
- the application of carbon capture, utilisation and storage (CCUS) technologies.

Towards 2030, the EC's indicative trajectory for this sector assumes a 46% reduction compared with 2005. Achieving this level will require continued emission cuts consistent with the pace observed over the past five years. Aggregated Member State projections that incorporate additional planned measures indicate a significant expected reduction in industrial emissions and alignment with the indicative 2030 trajectory.

Preliminary 2024 figures suggest that industrial emissions have stabilised relative to 2023.

2.1.5 Agriculture

In 2023, the agricultural sector accounted for 11% of total GHG emissions in the EU, a share expected to increase in the future. Most agricultural emissions are linked to livestock, with nearly half attributed to enteric fermentation and about 17.6% to manure management. N₂O emissions associated with fertiliser use represent a third major source.

Total GHG emissions from agriculture fell by 25.4% between 1990 and 2023, with significant reductions up to 2005 and relatively limited progress since. Between 2018 and 2023, the sector achieved an average annual reduction of 4.2Mt, equivalent to 1.1% of 2018 emissions.

Over recent decades, this reduction has been driven mainly by a decline in Europe's cattle population and a decrease in the use of both synthetic and organic fertilisers (EEA, 2024a; EU, 2023f). Non-CO₂ GHG emissions from the EU agriculture sector fell by 6.8% between 2005 and 2023 and estimates indicate a further 1.2% decrease between 2023 and 2024.

The EC's indicative 2030 trajectory for the agriculture sector identifies limited cost-effective mitigation potential in the short-term, projecting a 2030 emission level 8% below 2005 emissions. Member State projections suggest further reductions are possible, with aggregated 2030 emissions projected at 339MtCO₂e – approximately 13.4% below 2005 levels.

EU policy instruments, including the common agricultural policy (CAP) and the Certification Framework for Carbon Removals and Carbon Farming, are expected to promote further GHG reductions by encouraging adoption of sustainable agricultural practices.

Preliminary 2024 figures indicate a marginal 1.2% decline in emissions compared with 2023, consistent with the 1.1% average annual reduction observed over the previous five years.

2.1.6 Land use, land use change and forestry

As outlined in Section 1.3.2, the carbon removal capacity of the LULUCF sector has declined significantly over the last decade.

In 2013, the sector contributed to a net carbon removal of almost 350MtCO₂e. Ten years later, in 2023, net removals had fallen to 198MtCO₂e. The combined effects of climate change, natural disturbances in forests, intensified wood harvesting and reduced carbon sequestration by ageing forests have led to a substantial decline in the LULUCF sector's GHG absorption capacity (EEA, 2024d). As a result, net GHG emissions from LULUCF activities moved in the wrong direction and the EU is not on track to meet its 2030 target for this sector.

Because the LULUCF sector depends heavily on natural processes, there are no simple or immediate solutions to reverse this trend. Moreover, the transformation of European forests needed to improve climate resilience may reduce carbon stocks in the short- to medium-term.

Reaching the 2030 target – to achieve an additional LULUCF removal of 42MtCO₂e compared with 2016-2018 average – requires a reversal of the trend observed over the past decade.

Aggregated Member States projections suggest that this target will not be reached. Even in scenarios that include additional policies and measures, the LULUCF sink in 2030 is projected to be around 40MtCO₂e lower than the 2016-2018 average (after the comprehensive review), instead of 42MtCO₂e higher.

On a positive note, 2023 data and preliminary 2024 estimates suggest a temporary reversal of the negative trend, with the EU's carbon sink increasing by 15Mt (8.3%) in 2023 and 13Mt (6.8%) in 2024. New and reinforced policies will be needed to sustain this positive development.

Measures with additional mitigation potential include:

- increased afforestation and reduced deforestation;
- improved forest management;
- greater cascading use of harvested wood products to maximise climate mitigation potential;
- rewetting of drained soils rich in carbon, such as peatlands;
- improved crop rotation and grassland management (EEA, 2024d).

The revised LULUCF Regulation sets clear targets for Member States, providing a key driver for action. Further policy measures could come through stricter biomass sustainability criteria under the RED and a robust certification framework for carbon farming, carbon removals and carbon storage in products.

Box 2.1

Indirect emissions of electricity and district heating have to be considered

GHG emissions are reported in GHG inventories under source categories defined by IPCC guidelines, following a transparent and largely standardised structure. This reporting framework groups emissions by sector, primarily according to the location where they occur. However, in addition to this sector-based approach, it is also useful to allocate certain energy-related emissions to end users.

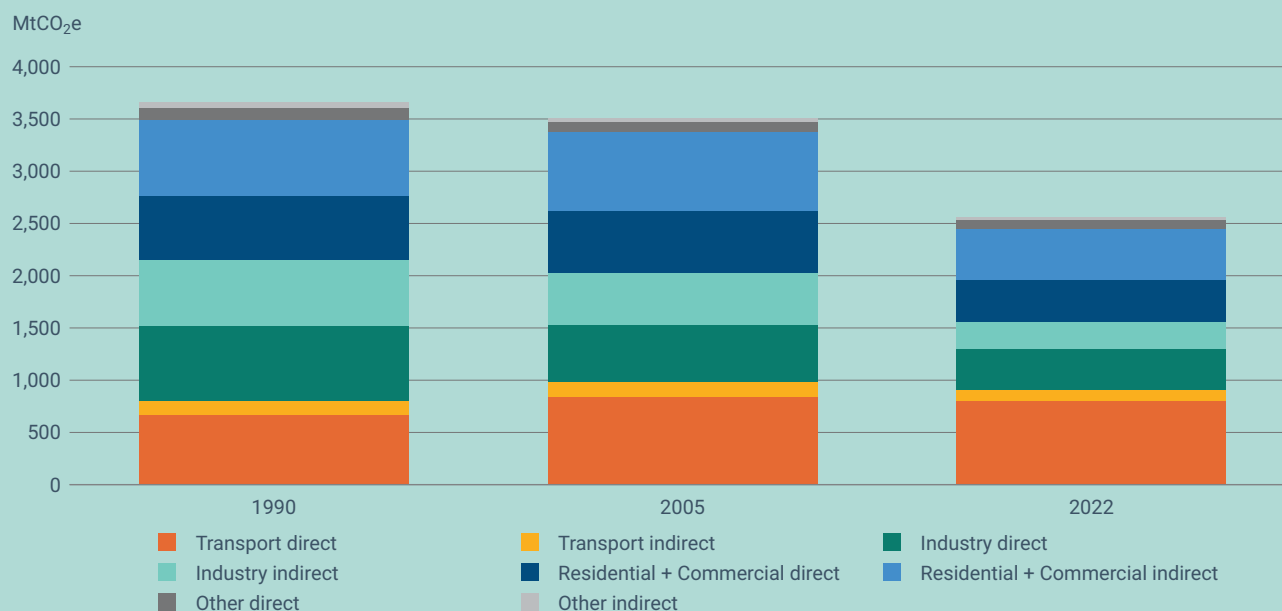
Figure 2.2 shows the evolution of total end user from 1990 to 2022, expressed as the sum of direct and indirect emissions:

- Direct emissions correspond to those reported in GHG inventory categories.
- Indirect emissions are those reallocated from the energy supply sector (including energy industries and fugitive emissions) based on energy use data reported in energy statistics for each end user sector.

Together, these end user emissions account for approximately 75% of total GHG emissions in the EU-27. Between 1990 and 2022, total end user emission declined by 30.2%, with largest reductions occurring in the industry sector (52%), followed by the residential sector (40.7%). In contrast, transport sector emissions increased by 13.4% during the same period.

When indirect emissions are reattributed, the industry sector becomes more prominent in the total distribution. Nevertheless, its indirect emissions decreased by almost 60% over this period, resulting in the transport sector becoming the largest contributor to total end use emissions in recent years.

Figure 2.2 Direct and indirect GHG emissions allocated to end use sectors of EU-27



Note: MtCO₂e, million tonnes of CO₂ equivalent.

Source: Author's compilation based on data from EEA (2025g).

2.2 Deep dive: sectoral trends and projections under the EU ETS

Complementing the sectoral analysis, it is also important to examine emissions covered under the different scopes of the EU ETS, established by EU law through the ETS Directive (2003/87/EC)(EU, 2023b) .

The EU ETS is a cap-and-trade system, divided into two parts:

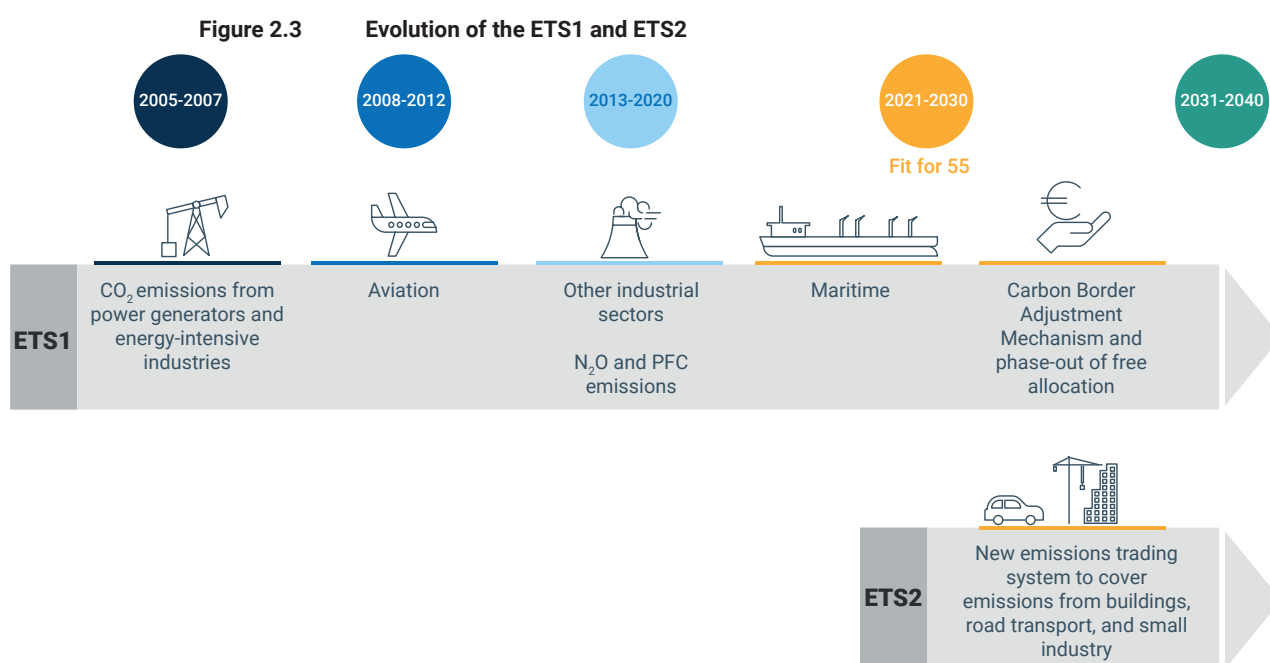
1. ETS1, in place since 2005, currently covers large energy and industry installations, as well as aviation and maritime activities.
2. ETS2, expected to begin in 2027, will cover road transport, buildings and non-ETS1 energy and industry emissions.

The balance between the legislated emission trajectories and actual verified emissions determines the resulting carbon price within these systems.

This section provides an in-depth examination of this central component of the EU's climate governance framework.

The EU ETS1 was launched in 2005 under Directive 2003/87/EC (EU, 2023b), initially covering the power sector and selected energy-intensive industries. It has since expanded to include other industrial sectors, aviation (in 2012) and maritime transport (in 2024).

Over time, the EU ETS1 has undergone substantial reforms, increasing both scope and ambition (see Figure 2.3).



Source: Adapted from (Böttcher, H. et al., 2025).

The EU ETS was the first international carbon market and remains the largest globally in terms of traded volumes. In 2024, the average EU allowance (EUA) price was EUR 65. With an auction share of 57%, this generated revenues of EUR 38.8 billion ⁽⁸⁾ under EU ETS1 (EC, 2025c). The system currently covers around 33% ⁽⁹⁾ of total EU-27 GHG emissions.

The EU ETS1 was established to help achieve the EU's climate targets and is a cornerstone of European climate policy. It has evolved over time and has become more efficient through successive design improvements, notably the introduction of a market stabilisation mechanism, which has enhanced the resilience of the EU carbon market (EC, 2025g).

As illustrated in Section 1.3.2, emissions from stationary installations under ETS1 decreased by 51% between 2005 and 2024. The 2030 target is set at an emission level 62% below 2005 levels.

The EU ETS1 operates as a cap-and-trade system, meaning that total emissions from covered sectors are capped at a predefined limit. Regulated entities must surrender EUAs equivalent to their verified annual emissions. As the cap declines over time – in line with the EU's climate targets – participants must either reduce their emissions or purchase additional EUAs to cover them. This mechanism reflects the 'polluter pays' principle.

Most EUAs are put on the market through auctioning, while free allocation of allowances continues for industries at risk of carbon leakage. This helps minimising the risk that companies relocate production to countries with less stringent climate policies, which could otherwise increase global GHG emissions.

EUAs are freely tradable on the carbon market, with prices determined by supply and demand. In theory, this ensures that emission reductions occur in the most cost-effective way, as the lowest-cost mitigation options are realised first.

During consecutive trading periods, the scope expanded in terms of both GHG – with the addition of industrial N₂O and perfluorocarbon (PFC) emissions – and the range of industrial activities covered. CO₂ emissions from the aviation sector have been included since 2012. Initially, the ETS covered both intra- and extra-EU flights, but it currently applies only to flights within the European Economic Area (EEA). In 2024, the EU ETS1 was extended to include emissions from the maritime sector.

During phase III (2013-2020), the EU ETS1 evolved into a fully harmonised EU-wide carbon market. A single EU-wide emissions cap replaced the national caps of the first two phases and auctioning became the default method for distributing EUAs.

Member States receive a large share of auction revenues, which are reinvested in decarbonisation projects. The Market Stability Reserve (MSR) was introduced in 2019 to address the surplus of allowances and strengthen market stability.

The current Phase IV was shaped by the European Green Deal, which raised the EU's climate ambition to a net 55% reduction in GHG emissions by 2030, compared with 1990 levels.

⁽⁸⁾ This number includes auction revenues from Iceland, Lichtenstein, Norway, Northern Ireland and the Innovation and Modernisation Fund.

⁽⁹⁾ The EU ETS1 currently covers 35% of the total EEA emissions in 2024, including emissions from the EU-27, Iceland, Lichtenstein and Norway. Emissions from aviation and navigation are included as in the scope of the GHG inventory.

Considering the cost-effective mitigation potential in the electricity and industry sectors, the 2030 ETS1 emissions cap was set at 62% below 2005 levels. This revision increased the Linear Reduction Factor (LRF) from 2.2% (2012-2023) to 4.3% for 2024-2027 and to 4.4% from 2028 onwards — accelerating the annual decline of the emissions cap (EC, 2025l).

To minimise the risk of carbon leakage and ensure equivalent carbon costs for imported and EU-produced goods, the Carbon Border Adjustment Mechanism (CBAM) was introduced. Following an initial reporting phase starting in 2023, the definitive period will begin in 2026, requiring importers to report emissions and purchase CBAM certificates corresponding to those emissions.

The current ETS Directive foresees the gradual phase-out of free allocations under the EU ETS for sectors covered by CBAM.

To further advance climate action in hard-to-decarbonise sectors, a new EU ETS2 has been established. It will start operating in 2027, covering CO₂ emissions from fuel combustion in buildings, road transport and small industries. Auctioning revenues from EU ETS2 will feed into the Social Climate Fund, created alongside the EU ETS2 to mitigate social and economic impacts and to support vulnerable groups in the transition towards climate neutrality.

The ETS1 and ETS2 systems will operate as separate systems under the current legislation, with distinct CO₂ prices and independent MSRs to balance supply and demand.

Since 2021, the CO₂ price in the EU ETS1 ranged between EUR 50 and EUR 100 per tonne of CO₂, compared with below EUR 20/tCO₂ between 2009 and 2018.

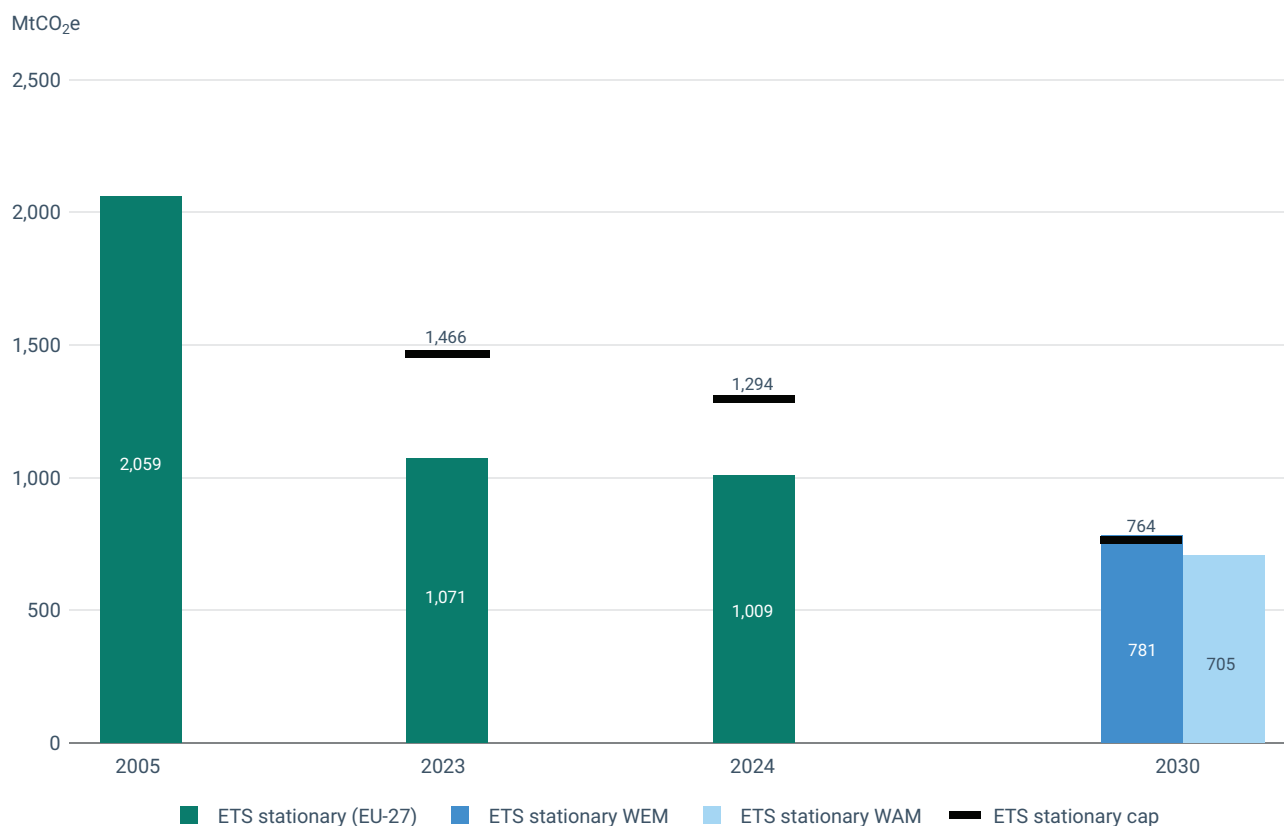
The CO₂ price in the EU ETS2 remains uncertain as the system has yet to start. The MSR for the ETS2 is calibrated to release additional allowances if the price exceeds EUR 45₂₀₂₀ /tCO₂ (EU, 2023b). Scenario analyses from the EU Climate Target Pan (Mix and Mix-CP scenarios) project allowance prices between EUR 48 and EUR 80₂₀₁₅/tCO₂ in 2030 (EC, 2021).

However, estimates vary widely across studies. The first ETS2 futures contracts, traded on the European Energy Exchange (EEX) in May 2025, were priced at EUR 73/tCO₂, closely mirroring the prevailing ETS1 price (Energate messenger, 2025).

2.2.1 Emissions of stationary installations under the ETS1

Emissions under the EU ETS1 are dominated by stationary installations, which accounted for over 92% of total ETS1 emissions in 2024. Since 2005, total stationary emissions in the EU-27 decreased by 51%, with most reductions observed for energy supply plants, such as power stations or district heating facilities. Energy supply plants emissions cover the largest share of ETS1 stationary emissions and emission reductions since 2005.

In 2024, stationary emissions were nearly 300Mt below the cap. For 2030, projections under the 'with existing measures' (WEM) scenario indicate that emissions will slightly exceed the cap, whereas under the WAM scenario, stationary emissions are projected to be 59MtCO₂e below the cap (see Figure 2.4 Evolution of stationary GHG emissions under the EU ETS1, 2005-2030).

Figure 2.4 Evolution of stationary GHG emissions under the EU ETS1, 2005-2030

Note: MtCO₂e, million tonnes of CO₂ equivalent.

Sources: Author's compilation based on data from EEA (2025b, 2025c).

2.3 Transport emissions covered under the EU ETS1

2.3.1 Aviation emissions

Since 2012, the EU ETS1 has included CO₂ emissions from aviation. The original EU ETS legislation intended to cover all flights departing from or arriving in the EEA ⁽¹⁰⁾. However, in 2012, the EU decided to temporarily limit the scope to intra-EEA flights only, starting in 2013. This decision – known as 'stop the clock' measure – was adopted to support the International Civil Aviation Organization's global mitigation mechanism, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) ⁽¹¹⁾. The reduced scope remains in place until 2027.

By mid-2026, the EC is expected to propose legislative amendments to the aviation component of the ETS. The Commission will assess whether CORSIA is delivering sufficient emission reductions and depending on the outcome, may propose to expand the EU ETS1 scope (EC, 2025o).

⁽¹⁰⁾ The EEA comprises of the 27 EU Member States and Iceland, Liechtenstein and Norway – three of the four Member States of the European Free Trade Association (EFTA).

⁽¹¹⁾ CORSIA is a global offsetting scheme that, with some exemptions for Least Developed Countries, Small Island Developing States and Landlocked Developing Countries, applies to all international flights. Under CORSIA, airlines should purchase eligible carbon credits to offset emissions from international flights. Intra-EEA flights covered by the EU ETS1 are exempt from participating in CORSIA to avoid double pricing of emissions.

Emission trends and cap

In 2012, CO₂ emissions from aviation under the EU ETS1 amounted to 84MtCO₂. In 2013, emissions dropped sharply to only 53Mt, not due to an actual reduction, but because of the change in scope ⁽¹²⁾.

Aviation emissions then increased steadily until 2020, when they fell by 63% to 25Mt reflecting the impact of the COVID-19 pandemic and associated travel restrictions. Although emissions remained relatively low in 2021, they have since rebounded, reaching near pre-pandemic levels.

Until 2023, airlines received most of their aviation allowances (EUAs) ⁽¹³⁾ free of charge. From 2024, the share of free allocation has been gradually reduced and from 2026 onwards, airlines will no longer receive free EUAs. However, up to 20 million EUAs are reserved for airlines using Sustainable Aviation Fuels (SAFs), compensating for up to 100% of the additional costs of SAFs compared with conventional fuels (EC, 2025o).

Since January 2025, airlines are also required to monitor and report non-CO₂ emissions under the EU ETS1. Whether these non-CO₂ emissions – which may contribute to over half of aviation's global warming impact (EC, 2020b) – will be regulated under the EU ETS1 will be determined by the EC in 2027.

The aviation emissions cap under the EU ETS was 27.6MtCO₂ in 2024, declining annually by 4.3% until 2027 and by 4.4% from 2028 onwards (ICAP, 2022). This means that aviation emissions must decrease steadily to remain within the emission budget and comply with the EU ETS1 cap.

In 2024, the aviation sector contributed 5.2% to total EU ETS1 emissions, reaching 62MtCO₂, a 14.8% increase compared with 2023. Consequently, aviation emissions exceeded the sectoral cap by more than double, widening the overshoot observed in 2023.

Market functioning and projections

EUAs are perfect substitutes for EUAs and can be traded freely on the carbon market. Mitigating one tonne of CO₂ in the aviation sector is typically more expensive than both historical EUA prices and abatement costs in other sectors.

If aviation emissions exceed their sectoral target, other sectors within the EU ETS1 must compensate by achieving additional reductions, ensuring the system-wide cap is maintained. Projections from Member States for 2030 show constant emission levels. According to these projections, aviation emissions are expected to exceed the 2030 sectoral cap, reaching three times the level foreseen in the aviation cap for that year.

⁽¹²⁾ In 2012 the EU ETS1 included emissions from all outgoing and incoming flights. In 2013 this scope was reduced to intra-EEA flights only.

⁽¹³⁾ European Union Aviation Allowance.

2.3.2 Shipping emissions under the EU ETS1

In 2024, the EU ETS1 was extended to include CO₂ emissions from maritime transport, covering cargo and passenger ships exceeding 5,000 gross tonnage (GT). The system applies to 100% of emissions from within the EEA and 50% of emissions from voyages that depart from or arrive at an EEA port from elsewhere (EC, 2025p).

The scope of the EU ETS coverage for maritime transport will be phased in gradually:

- from 2026, the system will also cover CH₄ and N₂O emissions (EC, 2025m);
- from 2027, it will extend to offshore ships exceeding 5,000 GT.

In April 2025, the International Maritime Organization (IMO) agreed on a mid-term measure to reduce global GHG emissions from shipping, but the regulation has not been formally adopted as intended by the Marine Environment Protection Committee in October 2025. The new IMO measures include stricter global GHG fuel intensity standards and an economic mechanism that allows ships performing better than the standard to trade excess allowances with those exceeding the threshold (IMO, 2025).

The EU ETS1 Directive includes a review clause requiring the EC to assess the impact of the IMO measures once they have been formally adopted.

In 2024, maritime emissions ⁽¹⁴⁾ amounted to 89.8MtCO₂, representing 7.8% of the total EU ETS1 emissions for that year. Projections indicate a slight increase in emissions over time under current measures.

2.4 Emissions under the EU ETS2

As part of the policy package designed to achieve the EU's 2030 climate targets, a new and separate ETS system was introduced in 2023. This system is scheduled to become fully operational in 2027, following a transitional phase that began with emissions monitoring and reporting in 2025.

The EU ETS2 will cover CO₂ emissions from fuel combustion in the buildings and road transport sectors, as well as emissions from small industrial installations not currently included under the EU ETS1. This includes, for example, combined heat and power (CHP) plants, smaller installations in the food and drink industry and fuel combustion activities in industrial head offices. By 2030, the EU aims for the EU ETS2 to achieve a 42% emission reduction compared with 2005 levels (EC, 2025j).

Design and functioning of the EU ETS2

The EU ETS2 will complement other EU and national policies in the covered sectors by encouraging additional emission reductions through price incentives, helping Member States meet their targets under the ESR. Like the main EU ETS, the EU ETS2 is a market-based cap-and-trade system. Entities covered by the system must purchase and surrender allowances equivalent to their annual emissions and may trade surplus allowances with other participants.

⁽¹⁴⁾ Emission data is based on the reported emissions of shipping companies in the Union Registry.

Unlike the main ETS, the ETS2 will regulate upstream emissions. Fuel suppliers, rather than end users, will be required to monitor and report emissions and surrender allowances. All allowances under the EU ETS2 will be auctioned, with revenues shared between Member States and the Social Climate Fund (EC, 2025k).

While the allowance price will be determined by supply and demand, the system has been designed to start in a smooth and efficient manner. In 2027, the first year of operation, the volume of auctioned allowances will be 30% higher to enhance market liquidity. As in the existing EU ETS1, the ETS2 will include a dedicated, rule-based market stability reserve (MSR) to address insufficient or excessive allowances supply to the market. In addition, the EU ETS2 will feature a soft price ceiling during its first three years. If allowance prices exceed EUR 45₂₀₂₀/tCO₂⁽¹⁵⁾, allowances may be released from the MSR to address excessive price increases (EC, 2025k). Allowances may also be released if prices rise too rapidly. In the event of exceptionally high gas or oil prices in 2026, the start of the EU ETS2 may be postponed to 2028 to ensure smooth implementation.

The Social Climate Fund

Parallel to the EU ETS2 system, a Social Climate Fund (SCF) has been established to support most affected vulnerable groups during the transition towards a cleaner economy (EC, 2025a). The fund will enable Member States to assist low-income households, transport users and micro-enterprises — particularly those affected by energy or transport poverty (EC, 2025a).

The SCF will be financed through revenues from EU ETS2 allowance auctions and 50 million allowances transferred from the existing EU ETS. Together with a mandatory 25% contribution from Member States to their Social Climate Plans, the fund is expected to mobilise at least EUR 86.7 billion in public funding over 2026-2032.

To access this funding, Member States must submit national Social Climate Plans, detailing the measures and investments to be undertaken in support of vulnerable groups. This mechanism aims to ensure that the EU ETS2 contributes to emission reductions in a fair and socially balanced manner, without exacerbating inequalities.

Emissions and projections

Emissions within the EU ETS2 scope declined by 277MtCO₂e between 2005 and 2023, representing an 18.3% reduction.

In 2023, emissions from ETS2 sectors across the EU-27 amounted to 1,236MtCO₂, suggesting that these sectors are on track for a smooth start in 2027 if current reduction trends continue. The road transport, building heating and small industry sectors achieved a combined annual reduction of about 40MtCO₂ in 2023, mirroring the reductions recorded in 2022. This positive trend was mainly driven by the buildings sector, which achieved average year-on-year reductions of nearly 8% in both 2022 and 2023.

In the road transport sector, 2023 emissions declined for the first time in over a decade (excluding 2020), marking a significant reversal of the previous upward trend, with a modest decrease of around 1%.

⁽¹⁵⁾ Emission data is based on the reported emissions of shipping companies in the Union Registry.

Projections indicate that emissions under existing measures will decline by 14.3% between 2023 and 2030, leaving emissions 26% above the 2030 ETS2 cap. If additional policies and measures are implemented, emissions could decrease by 26% by 2030, although this would still exceed the 2030 cap by 8.6%.

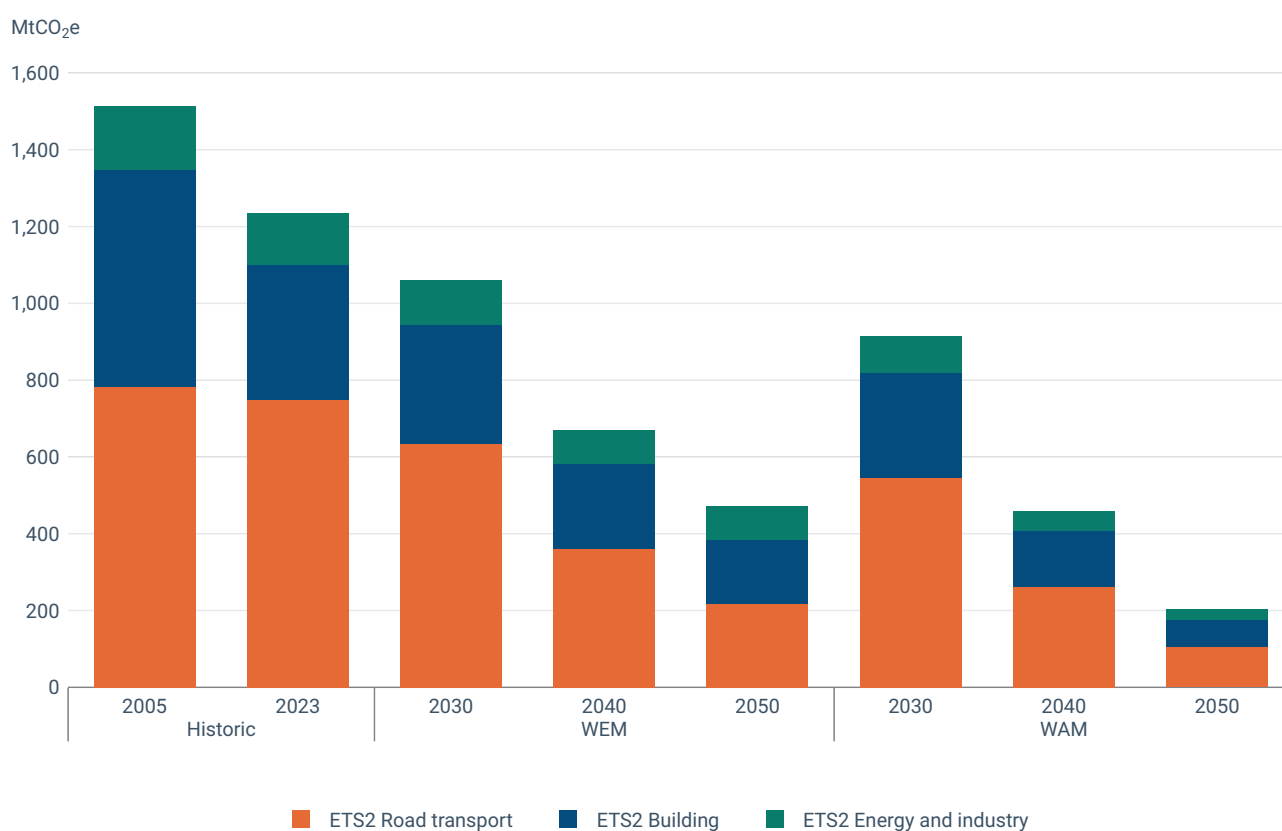
Since 2005, road transport emissions have been the main contributor to the emissions within the EU ETS2 scope. In 2023, road transport accounted for 60.6% of total ETS2 emissions.

Through to 2050, road transport is expected to remain the largest emitting sector within the EU ETS2, representing between 46.1% and 52.2% of total emissions (see Figure 2.5).

Projections that include additional policies and measures – beyond those already in place – indicate that road transport emissions could fall by approximately 203Mt by 2030 and by more than 487Mt by 2040, effectively reducing 2023 emissions by 65%. By 2050, these additional measures could result in reductions of up to 648MtCO₂, reductions, corresponding to an 86.5% emission reduction over the 26-year period.

The magnitude of emissions covered by EU ETS2 varies considerably across Member States, with a few countries (France, Germany, Italy, Poland and Spain) responsible for the largest share of emissions.

Figure 2.5 Evolution of ETS2 emissions for EU-27, 2005-2050

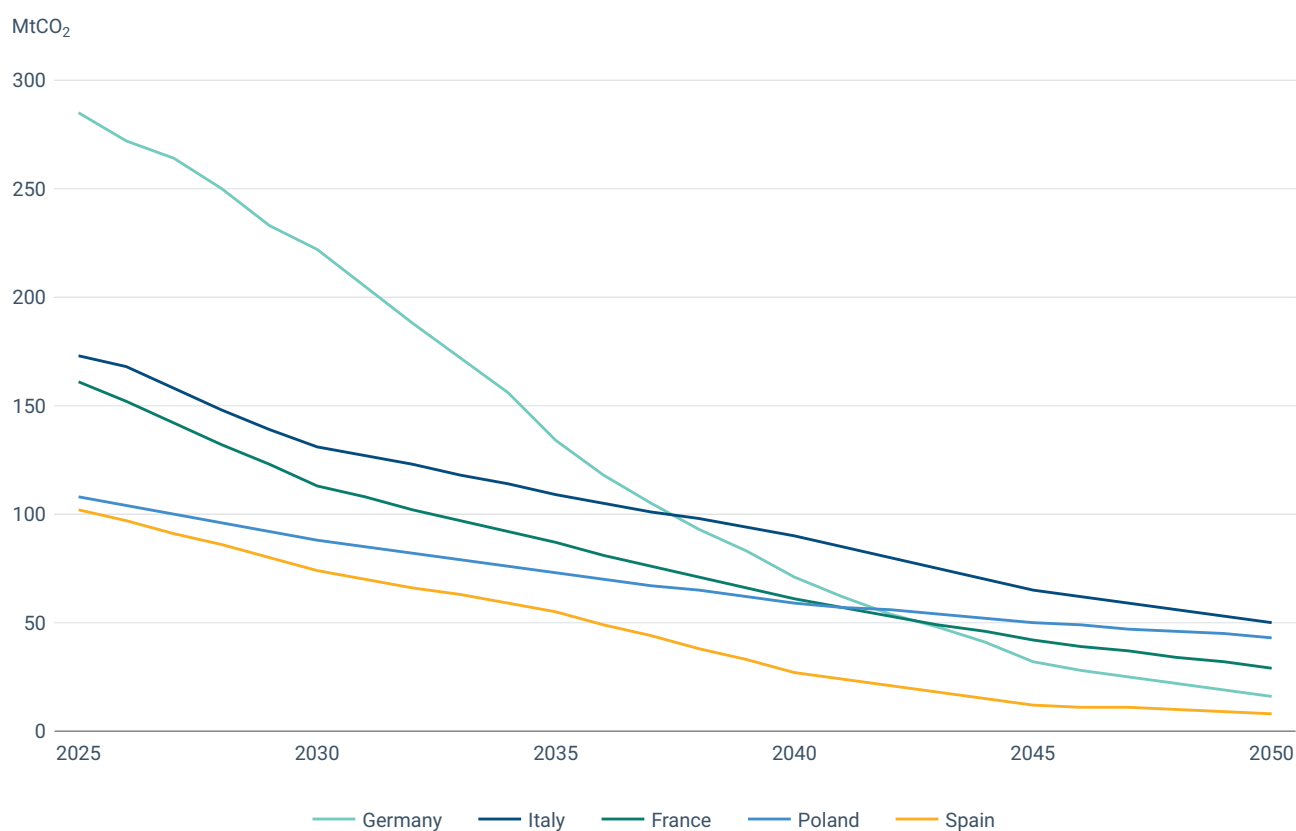


Notes: ETS2 emissions are an estimation. See the technical background report to this report for the methodology.

MtCO₂e, million tonnes of CO₂ equivalent.

Sources: Author's compilation based on data from EEA (2025b, 2025c).

Figure 2.6 Evolution of ETS2 emissions for Member States with highest ETS2 emission shares in 2023



Notes: Projected ETS2 emissions are an estimation based on submitted GHG projections. See the technical background document published alongside this report for the methodology.

MtCO₂, million tonnes of CO₂.

Sources: Author's compilation based on data from EEA (2025b, 2025c).

Figure 2.6 shows the evolution of EU ETS2 emissions for these top five emitters, which together accounted for around 70% of total EU-wide ETS2 emissions in 2023. Their combined share indicates that emission reduction developments in these large emitters will have the strongest influence on the overall supply and demand balance and price formation in the EU ETS2 market. By contrast, countries with smaller shares of ETS2 emissions are expected to exert less influence on overall price levels, as their contribution to aggregate demand is more limited.

Emission projections

All five top emitting Member States under the EU ETS2 are expected to reduce their emissions significantly by 2050 (Figure 2.6), with Germany projected to achieve the steepest decline. Between 2025 and 2030, Germany's emissions are projected to decrease by 22.2% and by 75.1% by 2040. As major emitters progressively reduce their emissions and thus their demand for allowances, other Member States are expected to become increasingly influential in stabilising allowance prices over time.

Box 2.2 highlights good practice examples from Member States that promote cost-effective decarbonisation for rapid impact across different ETS2 sectors.

Box 2.2

Effective policies and measures in EU ETS2

The EC's study *Assessment of supporting measures promoting decarbonisation in the sectors covered by ETS2* (EC, 2025n), identifies good practices of supporting measures that demonstrate how Member States can effectively promote targeted decarbonisation in EU ETS2 sectors, with a particular focus on lower and middle income groups affected by the transition (EC, 2025n). The study highlights measures already successfully tested and implemented across the EU, selected for their replicability, scalability, cost-effectiveness and short-term decarbonisation potential.

Buildings

For the buildings sector, one notable good practice is reducing electricity prices through mechanisms such as dynamic tariffs and reduced value-added tax (VAT). These measures enable households to lower operational and fiscal costs, while accelerating the payback period of investments in heat pumps. In Germany, for example, dynamic electricity tariffs encourage off-peak electricity use to promote heat pump generation, while Belgium, Greece, Ireland, Luxembourg, Croatia, Malta and Spain apply reduced VAT rates on electricity consumption.

Social leasing schemes for heat pumps and targeted information campaigns are also effective tools. Finland has promoted heat pump performance in cold climates, while the Netherlands provides online tools and tailored advice to help homeowners select suitable systems. Such approaches improve consumer confidence and adoption rates. Leasing or a subscription-based models represent an emerging best practice, helping overcome one of the main barriers to deployment — the high upfront investment cost.

On-bill-financing schemes in the Netherlands, France and Italy allow homeowners to fund renovations through their energy bills, using energy savings to cover costs. These programmes address barriers related to long payback periods and limited access to upfront capital.

In Slovenia, state-guaranteed loans for energy efficiency support elderly apartment owners by reducing lender risks and improving access to financing for renovations.

Energy efficiency information programmes in Latvia, Czechia, Slovenia, France, Belgium, Spain and the Netherlands offer tailored advice and digital tools to guide homeowners through renovation planning and efficient energy use, addressing both knowledge gaps and financial constraints.

Transport

In the road transport sector, financial incentives for grid connections to support charging infrastructure stand out as best practices. Germany, Spain, France and Ireland provide subsidies to lower upfront investment costs for companies developing charging networks.

Germany's inclusion of privately charged vehicles within the GHG quota system — which functions as a form of GHG pricing — represents another innovative measure, making private charging economically viable and promoting fleet electrification.

Belgium's tax deductibility policy for zero-emission vehicles accelerates the transition of company fleets by phasing out tax benefits for internal combustion vehicles and increasing deductibility for zero-emission models.

Several countries — including Austria, Belgium, Denmark, France, Germany, Luxembourg, the Netherlands, Norway and Sweden — have introduced emission-based taxes and road tolls that make zero-emission vehicles financially more attractive by penalising higher-emitting alternatives.

3 Greenhouse gas emissions and energy trends in European countries

Key messages

- Between 2005 and 2024, all Member States reduced their EU ETS1 emissions, largely driven by the shift from fossil fuels to renewable energy in electricity generation. However, emissions within the scope of the ESR have not decreased uniformly across the EU. Seven of the 27 Member States recorded increased emissions, primarily due to growth in the transport sector.
- Projections reported in 2025 show a significant development in Member States' expected ESR emission reductions through 2030 compared with last year's report. Under existing policies and measures, five Member States (Denmark, Greece, Bulgaria, Portugal and Czechia) expect ESR emissions below their 2030 targets, with Bulgaria and Greece showing the largest differences.
- In contrast, Malta and Ireland project to face the largest gaps, of 61 and 33 percentage points, respectively. Overall, the aggregate ESR emissions projected under existing measures correspond to an EU-wide reduction of 31% compared with 2005 base year levels, leaving a gap of 9 percentage points to the overall 40% target.
- When planned additional measures are included, the projected reduction increases to 38%, narrowing the gap to only two percentage points from the overall target. Unlike in previous years, these projections suggest an EU-wide surplus of nearly 100 million AEA for the 2021-2030 period.
- Estimates for 2024 indicate that 19 Member States increased their renewable energy shares between 2023 and 2024. The share of renewables ranged from 14% in Belgium to 66% in Sweden. The largest increase was observed in Lithuania, which raised its renewable energy share (RES) by three percentage points year-on-year. Conversely, Croatia's RES share is estimated to have declined by three percentage points compared with 2023.
- The EU is estimated to have reduced its final energy consumption by 12.9% between 2005 and 2024, while preliminary data indicate a reduction of 18.3% in primary energy consumption. Czechia, Slovakia and Estonia experienced the sharpest declines in primary energy consumption. In contrast, 18 Member States are estimated to have recorded increases in primary energy consumption in 2024, with the relative largest growth in Austria, Malta and Portugal, ranging between 5.6% and 6.6%.

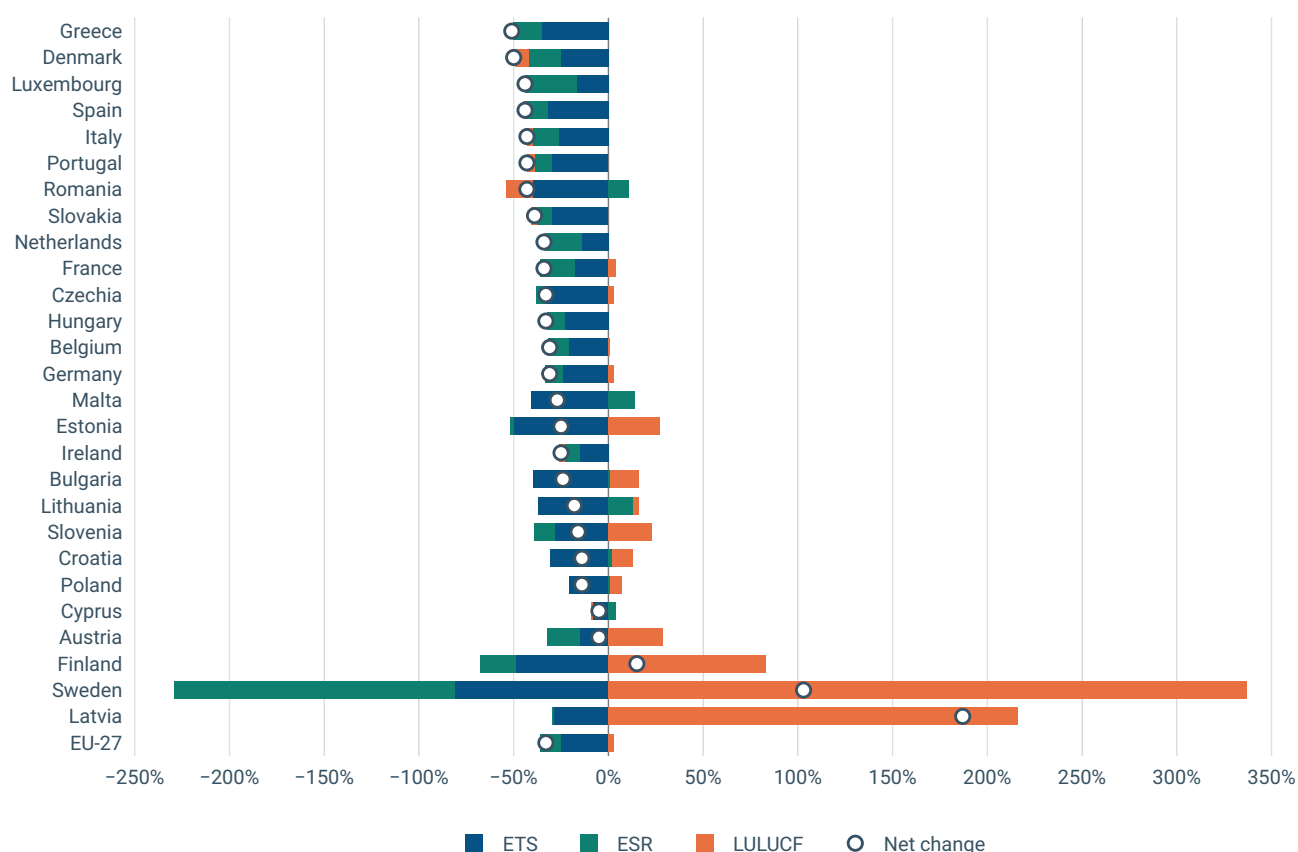
3.1 GHG emission development of Member State

The EU's target of achieving net zero GHG emissions by 2050 depends on the contributions of all Member States. These contributions vary considerably in both magnitude and drivers of emission change. While all Member States must reduce their emissions to meet the EU-wide net zero target, some are closer to this goal than others.

Figure 3.1 shows the relative development of total net emissions for each Member State between 2005 and 2024, differentiated into emissions covered by the EU ETS1, the ESR sectors and LULUCF. The evolution of net emissions varies significantly across Europe and is strongly influenced by national circumstances and starting points. Net emissions halved in Greece and Denmark, whereas Finland, Sweden and Latvia have recorded increases due to reductions in their LULUCF carbon sink.

As shown in Figure 3.1, since 2005, all Member States have achieved reductions in their EU ETS1 emissions, ranging from -14.4% in Cyprus to -71.5% in Luxembourg. In contrast, ESR emissions increased in seven Member States during the same period. Changes in ESR emissions range from a 38% reduction in the Netherlands to a 41.6% increase in Malta, relative to each country's ESR base year emissions.

Figure 3.1 Evolution of ETS1 and ESR emissions and LULUCF removals and emissions by Member State, 2005-2024



Notes: In this figure, the absolute changes in emissions under the ESR, ETS and LULUCF are expressed as percentage changes relative to total net GHG emissions in 2005. This representation breaks down the overall change in total net GHG emissions between 2005 and 2024 into the contributions of each policy instrument. For Sweden, the net change amounts to 103% and for Latvia, 187%. Both countries were close to net zero in 2005. Although ETS and ESR emissions decreased between 2005 and 2024, the decline in the LULUCF carbon sink dominated the trend, leading to higher net emissions in 2024. Compared to the analysis of last year, the net result for Sweden changed considerably due to a revision of historic net LULUCF results in the GHG inventory.

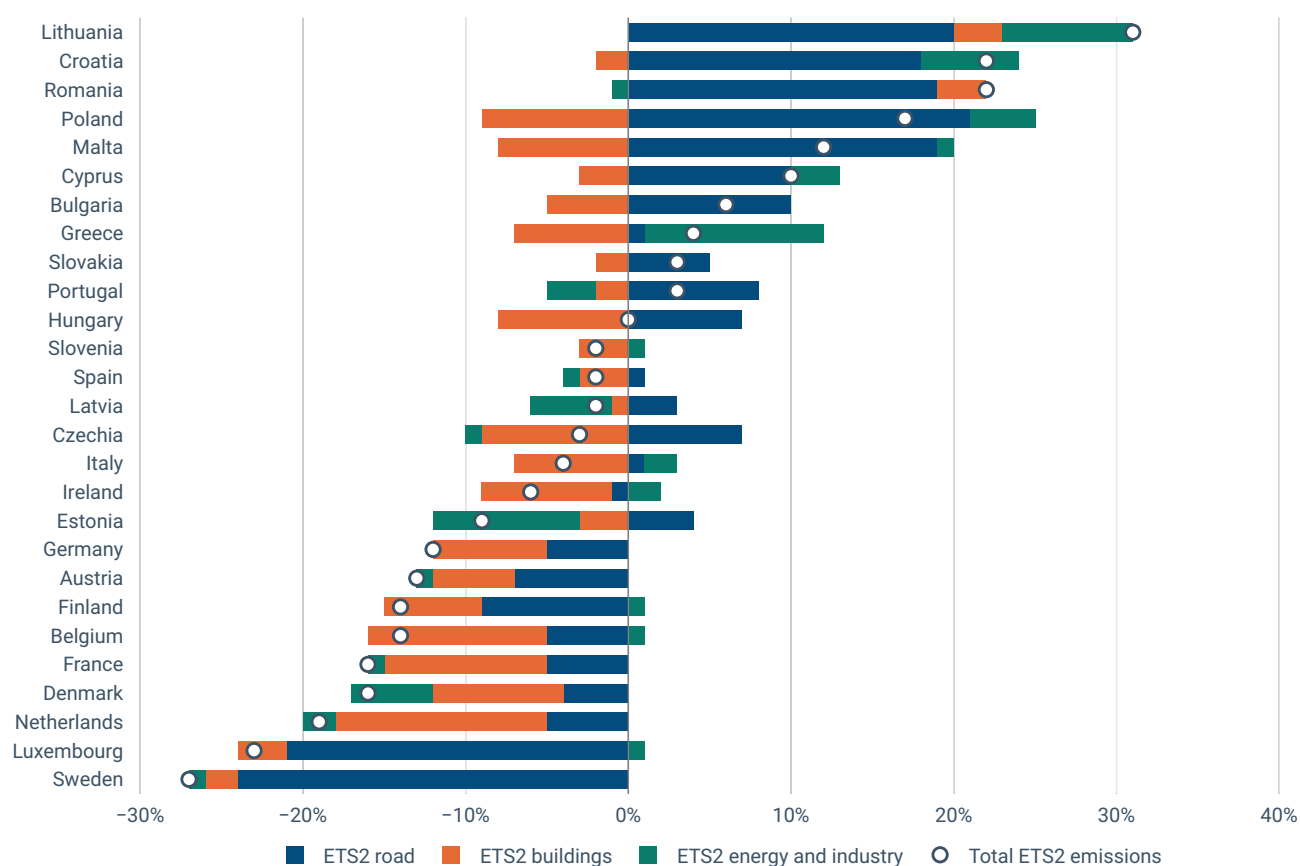
Sources: Author's compilation based on data from EEA (2025b, 2025c, 2025h).

Regarding GHG emissions and removals associated with the LULUCF sector, more than half of the Member States have achieved growth in their net LULUCF sink since 2005. On EU-27 level, the LULUCF sink decreased between the years 2024 and 2005 by 135MtCO₂e, with Finland, Germany and Sweden contributing most with close to 100MtCO₂e. Highest increases of the LULUCF sink in absolute terms occurred in Italy, Romania and Denmark, while the sink decreased most with a total of 41MtCO₂e.

As the EU ETS2 system has not yet entered into operation, no verified emissions data are available. However, estimates can be derived based on the definition of the system's scope. For further detail see the technical background document published along this report.

Figure 3.2 presents the relative change in total EU ETS2 emissions and sectoral breakdowns between 2015 and 2023, expressed as percentage changes relative to 2015 levels. During this period, ETS2 emissions declined in this timeframe in 17 Member States.

Figure 3.2 Development of ETS2 emissions by Member State, 2015-2023



Note: ETS2 emissions are an estimation. See the technical background document published alongside this report for the methodology.

Sources: Author's compilation based on data from EEA (2025b, 2025c).

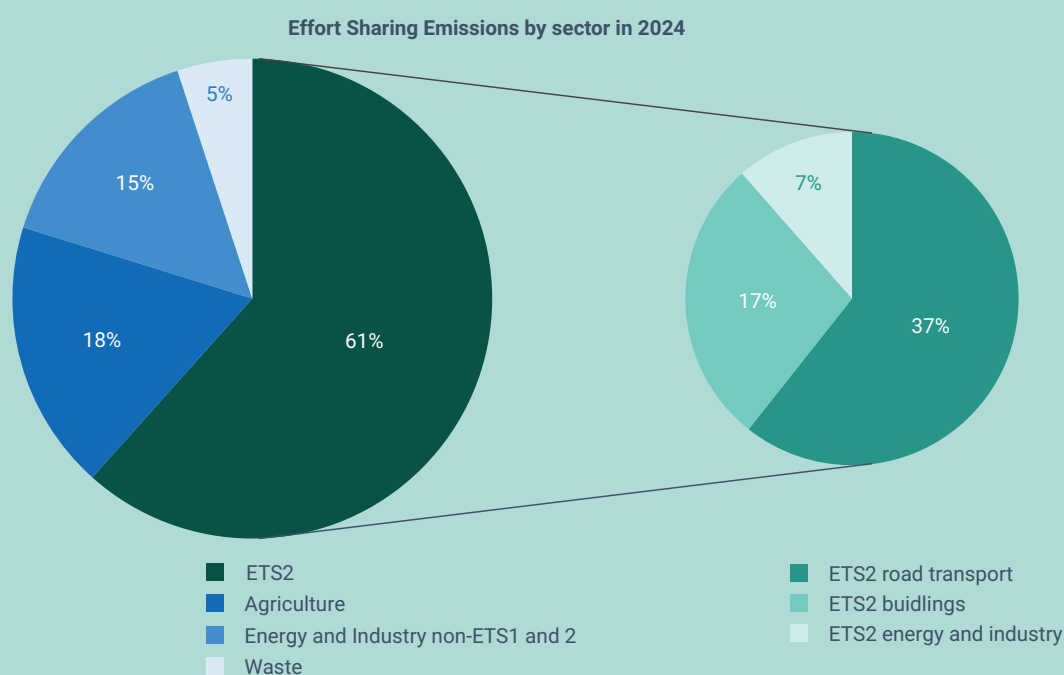
Changes in road transport, buildings and ETS2 energy and industry emissions vary substantially across Member States. Sweden and Luxembourg achieved the largest emission reductions in the road transport sector, of 24% and 21%, respectively. In the buildings sector, emissions fell in most Member States, except in Lithuania and Romania. Among Member States with an increase in total ETS2 emissions, Greece recorded the largest rise in EU ETS2 energy and industry emissions, of 11%. In all other Member States where ETS2 emissions increased since 2015, the road transport sector was the main driver of the rise.

Box 3.1

Relation between ETS2 and ESR

In 2024, EU ETS2 emissions accounted for 61% of total EU ESR emissions, leaving agriculture, waste and certain energy and industrial emissions covered solely by the ESR. The planned EU-wide reduction of EU ETS2 emissions – 42% by 2030 compared with 2005 levels is consistent with the EU-wide ESR target, which aims for a 40% reduction over the same period.

Figure 3.3 EU-level ETS2 and ESR emissions in 2024



Notes: 2024 estimates are based on GHG proxies.
Figures might not sum up to 100% due to rounding.

Sources: Author's compilation based on data from EEA (2025b, 2025c).

3.2 Progress to national emission targets

The ESR sets binding national targets to reduce emissions from domestic transport (excluding CO₂ emissions from aviation), buildings, agriculture, small industry and waste, by 2030. These national targets are expressed as percentage reductions relative to 2005 emission levels, ranging from 10% to 50%.

These 2030 national emission reduction targets are translated into AEAs for each year from 2021 to 2030, based on defined trajectories with binding annual emission limits for each Member State. Member States can use several flexibility mechanisms to ensure compliance with these limits.

Following the 2023 amendment of the ESR, national 2030 targets were raised and stricter annual emission limits were introduced for 2023-2029. As a result, the national reduction paths towards 2030 became steeper for all Member States, except Malta. Iceland and Norway have also agreed to implement the ESR and are committed to binding 2030 emission reduction targets.

Figure 3.4 Emissions in the effort sharing sectors in 2023 and 2024 compared to the annual emission allocations



Note: ESR targets for Iceland and Norway still have not been adapted to the more ambitious overall 2030 target.

Sources: Author's compilation based on data from EU (2023a); EEA (2025h).

In 2023, emissions in the effort sharing sectors were below the AEAs for all Member States except Croatia, Cyprus, Denmark, Ireland, Italy and Malta (before flexibilities). Sweden, the Netherlands and Luxembourg achieved the largest reductions relative to their 2005 base year emissions.

Preliminary estimates for 2024 indicate that Czechia, Greece, Hungary, Latvia, Luxembourg, the Netherlands, Poland, Portugal, Slovakia and Slovenia remained below their AEAs, while the other 17 Member States had emissions above their annual limits (before flexibilities).

For both Norway and Iceland, effort sharing emissions exceeded AEAs in 2023 and preliminary 2024 estimates suggest this trend continued (before flexibilities).

Based on the projections submitted in March 2025, five Member States – Bulgaria, Czechia, Denmark, Greece and Portugal – project effort sharing emissions below their 2030 targets under existing policies and measures (WEM).

All other Member States project a gap between their 2030 effort sharing emissions and 2030 targets under WEM (see Fig 3.5). Malta shows the largest gap, of 61 percentage points, followed by Ireland, with a difference of 33 percentage points. When additional planned policies and measures are included, 15 Member States project emissions below their 2030 effort sharing targets: Bulgaria, Croatia, Czechia, Denmark, Greece, Hungary, Latvia, Lithuania, Luxembourg, Romania, Poland, Portugal, Slovakia, Slovenia and Spain.

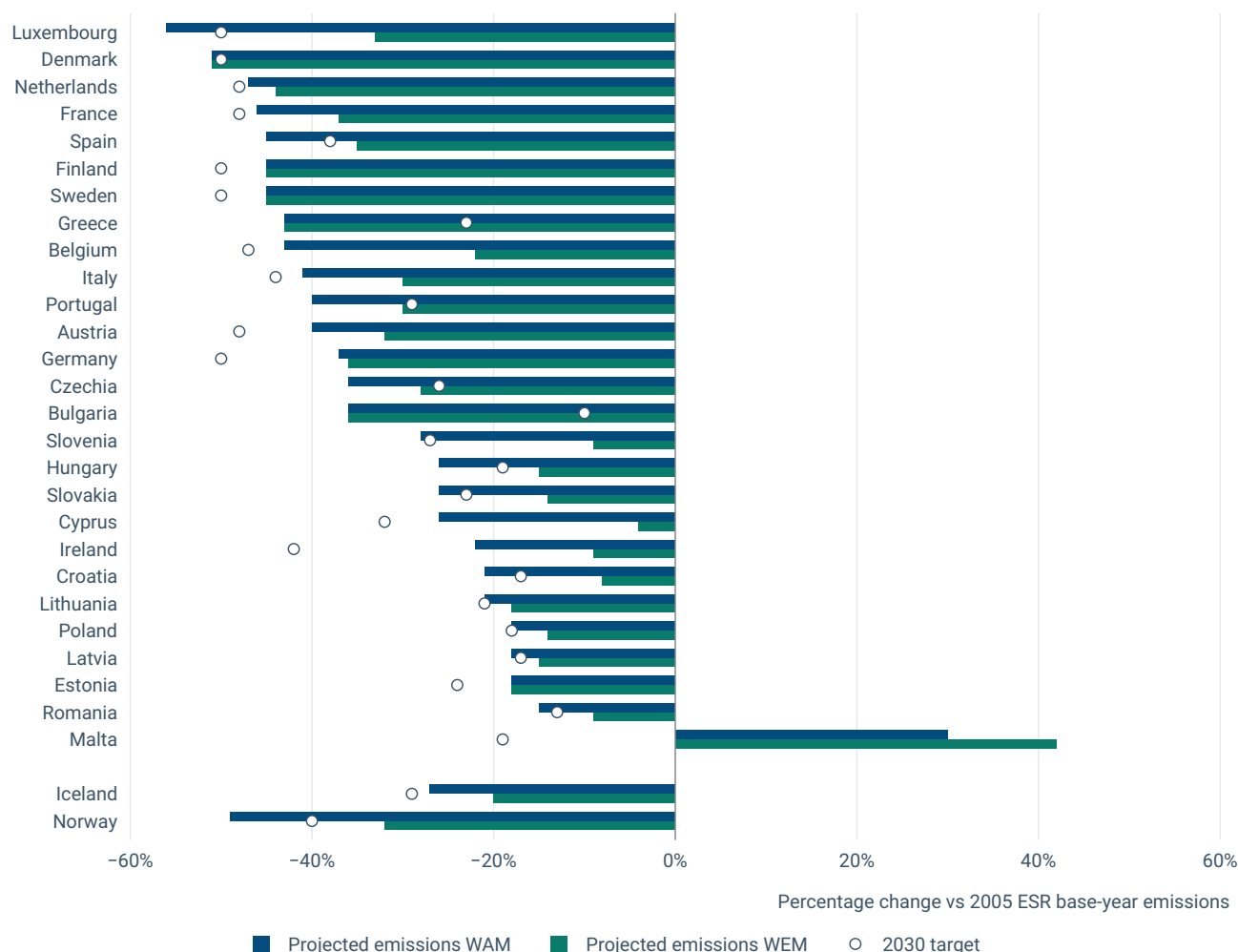
Malta's emission trends and structural challenges

Even when additional policies and measures are included, Malta's ESR emissions are projected to increase by 49% compared with current ESR levels.

Historically, Malta's effort sharing emissions have exceeded its AEAs every year since 2013, except in 2021, when an additional AEA adjustment was applied under Article 10(2) of the ESR. Malta's NECP highlights several structural challenges in reducing GHG emissions, stemming from its geographic and economic context. As a small island on the EU periphery, Malta has no domestic energy resources, possesses limited land area and high import dependence. These factors limit control over supply chains, constrain carbon sequestration potential and prevent economies of scale for new technologies (Malta, 2025). Moreover, government subsidies insulate fuel prices for final users from global market fluctuations (Malta, 2025).

With the updated ESR projections submitted by Member States, the EU-wide picture under additional policies and measures now points to a surplus of nearly 100 million AEA over 2021-2030. This contrasts sharply with last year's projections, which indicated a deficit of 358 million AEA. As the balance between AEA and ESR emissions for 2021-2024 remains similar to last year's assessment, the improvement results solely from lower aggregated ESR emissions in the latest projections. Only five Member States project higher ESR emissions in 2030 than last year (Austria, Germany, Ireland, Italy and Portugal). The largest positive differences between ESR emissions and AEAs across the period 2021-2030 occur in France (+203Mio AEA), Poland (+87Mio AEA) and Romania (+53Mio AEA). Conversely, Germany's ESR emissions have increased considerably in the latest projections, leading to an expected overall deficit summing up to 207 million AEA in 2030.

Figure 3.5 Projected emissions in the effort sharing sectors in 2030 compared to Member States' national targets



Note: Effort sharing targets for Iceland and Norway have still not been adapted to the more ambitious overall 2030 target. For Bulgaria, Denmark, Estonia, Finland, Greece and Sweden, the values shown in both bars of the chart are the same, as they only submitted projections based on exiting policies and measures. AEAs for 2026-2030 are calculated on the basis of reviewed ESR emissions 2021-2023. They do not include ETS opt-outs and are therefore preliminary. The adoption of the final AEAs is still outstanding at the time of publication or this report.

Sources: Author's compilation based on data from EU (2023a, 2023c), EEA (2025h); EEA (forthcoming), EC (forthcoming).

The revised LULUCF Regulation (EU, 2023f) sets an EU-wide net removal target of -42MtCO₂e for 2030 as compared with the average for the reference period 2016-2018. The target is distributed among Member States through individual national targets, requiring each Member State to increase the ambition of its land use policies. Achieving these national targets shall result in total net removals of -310MtCO₂e in 2030.

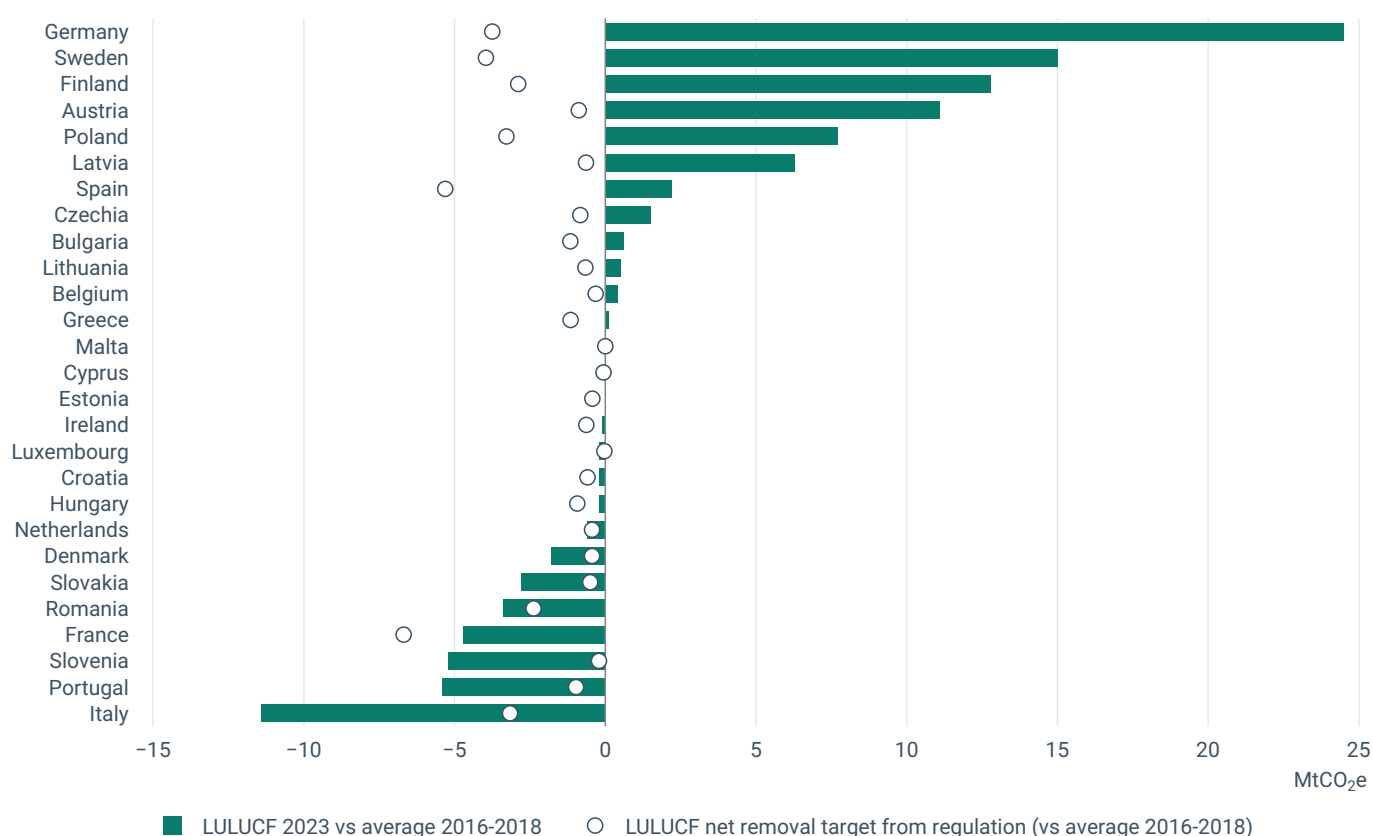
For the 2021-2025 period, Member States must meet a national 'no debit' target, ensuring that accounted GHG emissions from land use, land use change or forestry do not exceed total accounted removals. If a Member State's national LULUCF net sink exceeds the required level under the Regulation, the surplus may be used as a flexibility mechanism under the ESR. Conversely, if the net sink is lower and no further flexibilities are available, the deficit must be balanced within the ESR.

Across the EU, the LULUCF net sink declined by 95MtCO₂e between 2016 and 2023.

For this analysis, LULUCF data after this year's comprehensive review have been used instead of the 2023 GHG inventory figures submitted in March. When comparing the reviewed 2023 net LULUCF removals with the 2016-2018 baseline (see Figure 3.6), 13 Member States show a decline in removal capacity, despite all having targets to increase removals by 2030. Currently, eight Member States report higher LULUCF net removals than their 2030 targets. However, national targets may still be adjusted, as the sum of current national targets amounts to nearly -315MtCO₂e, which slightly exceeds the EU-level target of -310MtCO₂e for 2030. The final national LULUCF targets will be calculated in 2032 ⁽¹⁶⁾.

Based on projections with additional measures for 2030, three Member States currently above their targets (Italy, Luxembourg and the Netherlands) are expected to see declines in their LULUCF performance, resulting in net removals below target levels in 2030. Furthermore, in three out of four Member States with the highest LULUCF net removals (France, Italy and Spain), their removal capacity is projected to decrease considerably, by 46MtCO₂e, even with additional policies and measures in place.

Figure 3.6 Net LULUCF removals in 2023 compared to the 2016-2018 average



Notes: This figure illustrates the change in net LULUCF removals in 2023 compared to the average removals during the 2016-2018 period. It also includes the 2030 net removal targets for each Member State, which according to the LULUCF Regulation, are expressed as additional removals relative to the 2016-2018 average of net LULUCF removals.

MtCO₂e, million tonnes of CO₂ equivalent.

Sources: Author's compilation based on data from EEA (2025b) and EU (2023e).

⁽¹⁶⁾ This analysis is complementing the official gap to target calculation of Article 4 of the LULUCF Regulation of the EC performed as part of the CAPR 2025.

Box 3.2

Changes in LULUCF information

In many EU Member States, GHG emissions and removals in the LULUCF sector can show substantial variations in levels and trends between submissions due to recalculations. Recalculations result from continuous improvements in GHG reporting methodologies, including the application of higher tier methods, inclusion of new datasets, for example from periodic national forest inventories (NFIs) and the use of updated emission factors.

Germany

The case of Germany illustrates the impact of such recalculations on reported LULUCF data. In its 2024 submission, Germany reported average net GHG removals from the LULUCF sector of -1.6MtCO₂e on average between 2000 and 2020. In its 2025 submission, the value was revised to average net emissions of 18.7MtCO₂e, reflecting both methodological updates and natural factors. For instance, improved mapping of soil carbon content and its changes affected the entire time series (UBA, 2025). In addition, the inclusion of new data from the recently published NFI reduced the net LULUCF sink from 2018 onwards. The 2025 NFI provided measured estimates for the 2017-2022 period, whereas previous submissions relied on extrapolations from the 2017 NFI. These earlier estimates did not capture the extensive spruce dieback that occurred between 2018 and 2020 and continued thereafter (Rock et al., 2025). Timely reporting of GHG emissions and removals from forests remains a challenge for Member States that depend on periodic NFIs (Böttcher, H. et al., 2025).

These findings underscore the need for targeted policies to ensure that the EU's overall LULUCF target is achieved by 2030.

3.3 Renewable energy

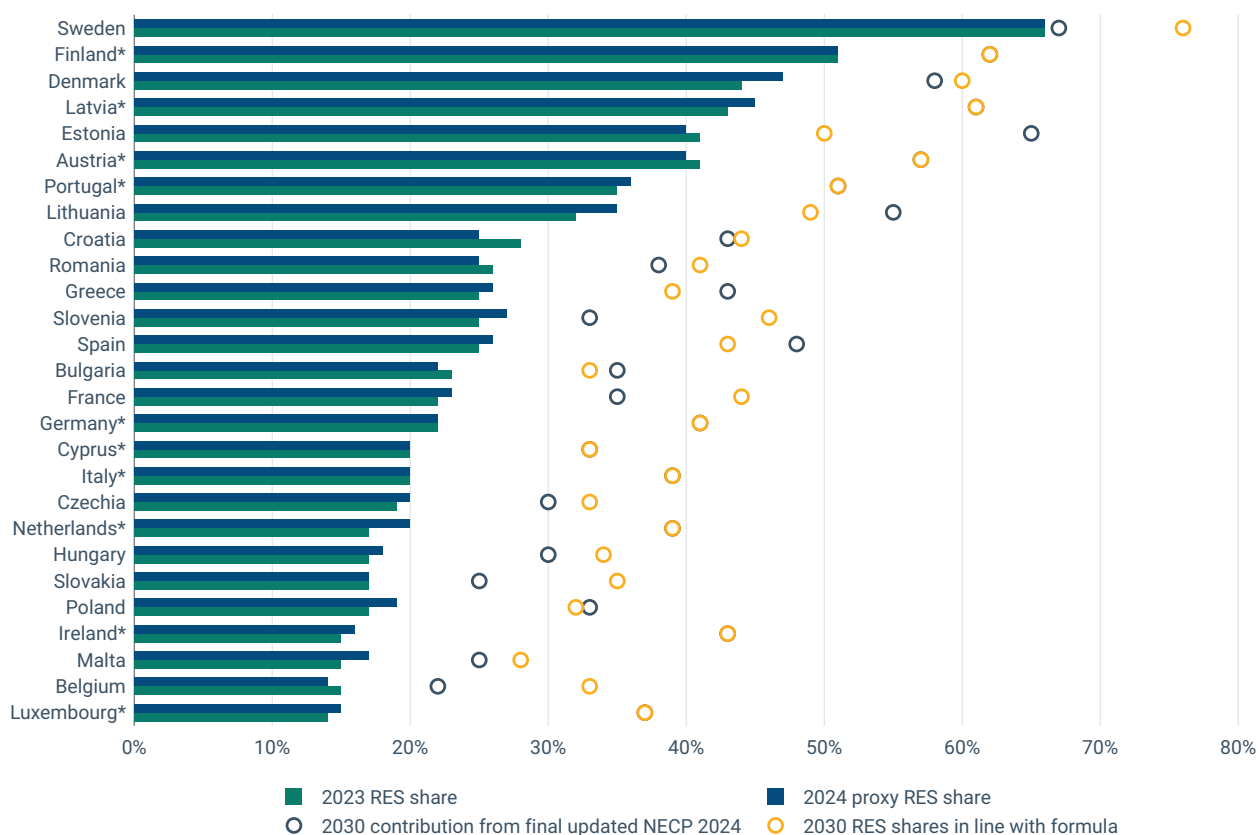
The RED raised the EU's 2030 renewable energy target from 32% to a minimum share of 42.5%, with the aim of reaching 45%. To achieve this objective, all EU Member States must include in their NECPs their individual contributions to the EU's overall 2030 renewable energy target, expressed as a share of gross final energy consumption. They should also define an indicative trajectory towards that target (EU, 2018).

Renewable energy deployment varies considerably across Member States. The EU's total renewable energy share of 24.6% in 2023 resulted from national shares ranging from 14.4% in Luxembourg to 66.4% in Sweden. For two Member States (France and Ireland) the 2023 renewable energy share did not yet reach their binding 2020 baseline level.

Preliminary estimates for 2024 indicate that RES share ranges from 14.3% in Belgium to 66.0% in Sweden. In total, 19 Member States increased their renewable energy shares between 2023 and 2024. The largest increase was observed in Lithuania, with an increase of 2.8 percentage points, while Croatia's RES is expected to have declined by 2.8 percentage points compared with 2023.

The expected 2030 RES share contributions set in Member States' final updated NECPs submitted in 2024 and 2025 range from 21.7% (Belgium) to 67.0% (Sweden). Seven Member States (Bulgaria, Estonia, Greece, Italy, Lithuania, Poland and Spain) set higher RES contributions than those calculated using the formula set out in the Governance Regulation (EC, 2025b).

Figure 3.7 2023 National progress to 2030 RES contributions and formula shares and 2024 estimates



Note: Up to 2023, the data includes statistical transfers. The following Member States received statistical transfers that year: Belgium (1% on total renewable energy), Germany (0.01%) and Luxembourg (17%). Denmark was the sole provider of these statistical transfers in 2023.

* Please note that for countries with an asterisk the data points '2030 contribution from final updated NECP 2024' and '2030 RES shares in line with formula' overlap.

Sources: Author's compilation based on data from Eurostat (2025g), EEA (forthcoming).

3.4 Energy efficiency

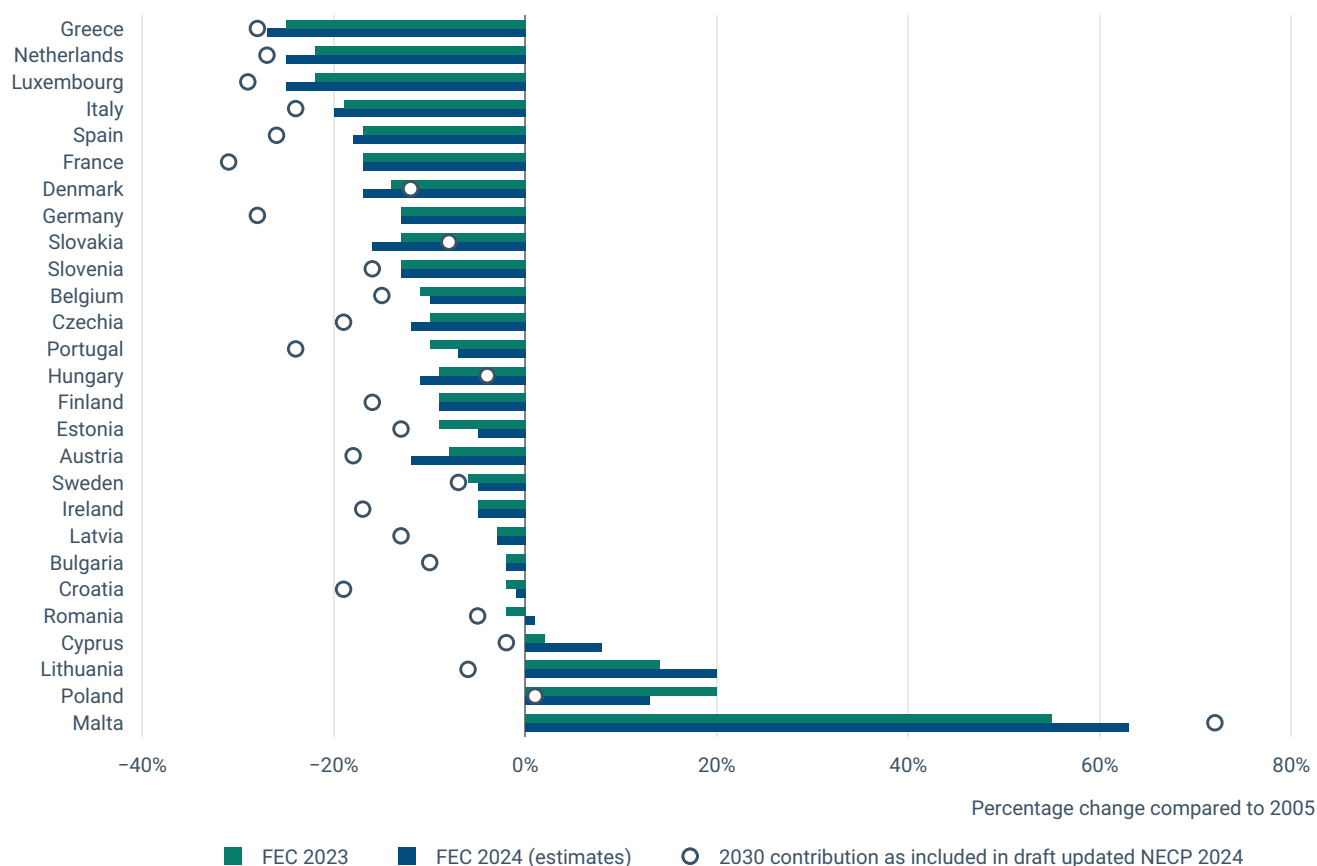
The EU has established EU-wide targets for both primary and final energy consumption, set at 992.5Mtoe and 763Mtoe, respectively. Member States contribute to these targets by submitting indicative national 2030 contributions for both final and primary energy consumption, each accompanied by an indicative trajectory. When calculating these national contributions, Member States have full flexibility in their approach, provided they consider a comprehensive set of factors and national characteristics as outlined in Article 4(3) of the EED.

Importantly, Annex I of the EED includes a formula enabling Member States to determine their contributions in a transparent and equitable manner. Member States submitted their final national energy efficiency contributions as part of their final updated NECPs, aligning with the revised European targets.

Between 2005 and 2023, the EU's final energy consumption decreased by 12.1%, with an estimated total reduction of 12.9% between 2005 and 2024. This overall decline in final energy consumption between 2005 and 2023 was observed in 23 Member States. Ten countries recorded reductions greater than the EU average over this period: Denmark, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Slovakia, Slovenia and Spain. As shown in Figure 3.8, four Member States recorded increases in final energy consumption between 2005 and 2023: Malta (+55%), Poland (+20%), Lithuania (+14%) and Cyprus (+2.2%). The notable increases in Poland and Lithuania were mainly driven by the transport sector, where energy consumption grew by 94% and 55%, respectively, between 2005 and 2023. In Malta, energy consumption rose across all sectors, with the largest increases observed in the transport and other sectors. In Cyprus, consumption increased in the other sectors, partially offset by a decline in the industry sector.

In 2023, total primary energy consumption in the EU was 19.3% lower than in 2005. Preliminary estimates for 2024 indicate a slight increase compared to 2023, with the overall reduction compared to 2005 estimated at 18.3%. Only two Member States experienced an increase in primary energy consumption between 2005 and 2023: Poland (+6.0%) and Cyprus (+1.7%). All other Member States recorded reductions, with the largest declines observed in Greece (-34%), Germany (-26%), Italy (-25%), Luxembourg (-23%) and the Netherlands (-23%).

Figure 3.8 National progress towards 2030 national final energy consumption contribution



Note: To ensure comparability with the energy efficiency contributions, this final energy consumption indicator follows the Eurostat methodology based on the definition laid out in Article 2 of the revised EED (FEC_EED).

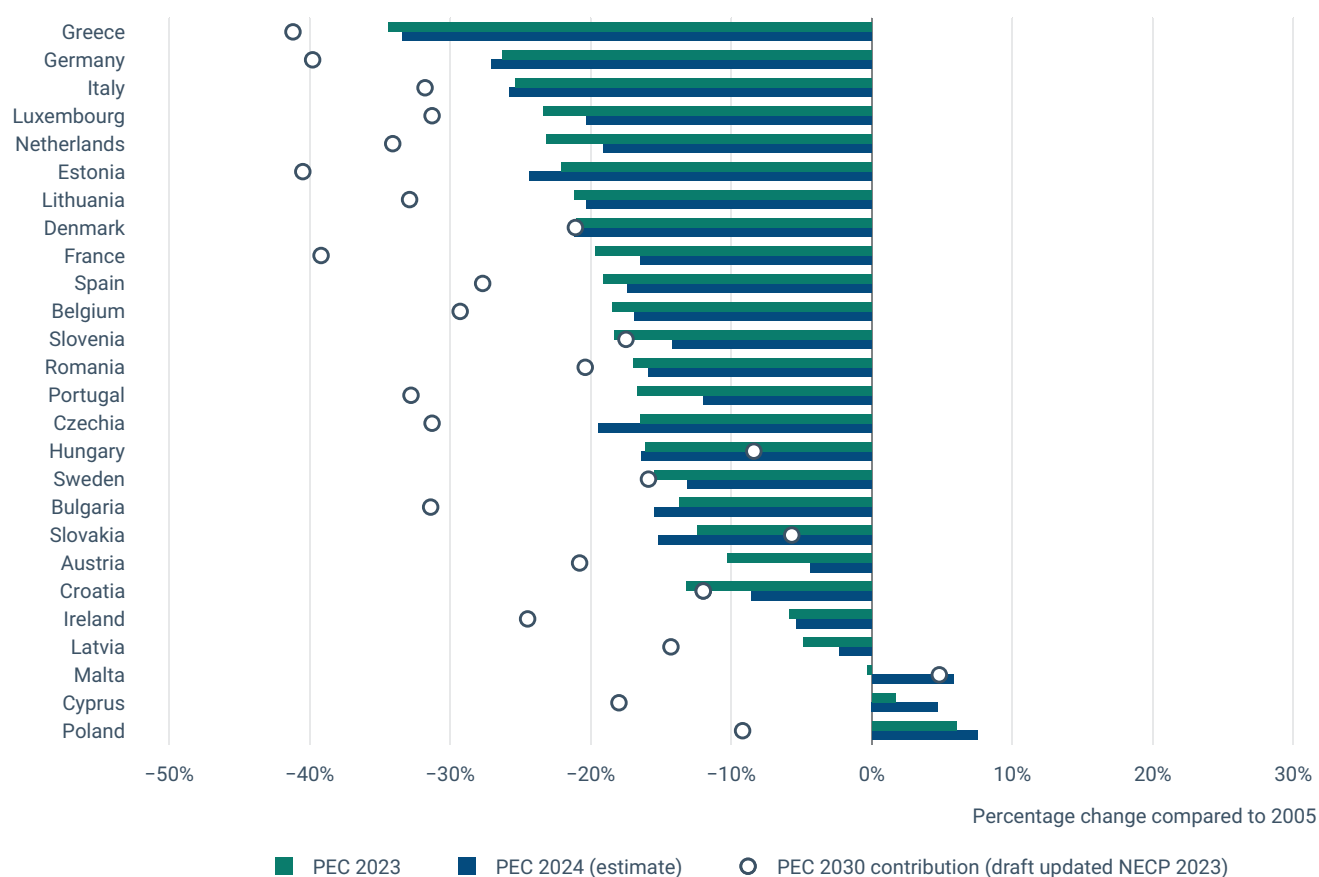
Sources: Author's compilation based on data from EC (2024a), Eurostat (2025b), EEA (forthcoming), EC (2025f).

According to preliminary 2024 estimates, final energy consumption decreased in 16 Member States compared to 2023, with the largest percentage reductions observed in Poland, Denmark and Austria. Lithuania, Cyprus and Malta had estimated highest increases in final energy consumption, although their growth rate was not higher than 1%.

Preliminary estimates for primary energy consumption for 2024 suggest a decrease in 9 Member States compared to 2023, with Czechia, Slovakia and Estonia experiencing the sharpest declines. Conversely, estimates show that 18 Member States have recorded increases in primary energy consumption in 2024 relative to 2023, with the highest annual growth rates observed in Austria (+6.6%), Malta (+6.1%) and Portugal (+5.6%).

According to the final updated NECPs submitted by Member States (EC, 2025f) contributions to the 2030 energy consumption targets are, on average, 6.4% lower than estimated final energy consumption and 11.1% lower than estimated primary energy consumption for 2024.

Figure 3.9 National progress on primary energy consumption



Note: To ensure comparability with the energy efficiency contributions, this primary energy consumption indicator follows the Eurostat methodology based on the definition laid out in Article 2 of the revised EED (PEC_EED).

Sources: Author's compilation based on data from EC (2024a), Eurostat (2025b), EEA (forthcoming), EC (2025f).

3.5 Energy and climate trends and projections in other EEA countries and Energy Community Contracting Parties

The previous sections primarily describe progress among EU Member States.

However, membership and cooperation within the EEA and the European Environment Information and Observation Network (Eionet) also include countries that are not members of the EU: namely Iceland, Liechtenstein, Norway, Switzerland and Türkiye – all of which have long-standing experience in reporting climate- and energy-related data.

Since 2023, the Contracting Parties to the Energy Community have also begun reporting climate and energy data in accordance with an adapted version of the EU Governance Regulation. The Energy Community brings together nine Contracting Parties that cooperate in the implementation of the EU acquis within the neighbouring region: Albania, Bosnia and Herzegovina, North Macedonia, Kosovo ⁽¹⁷⁾, Montenegro and Serbia, Georgia, the Republic of Moldova and Ukraine.

Climate and energy data reporting by the Energy Community has been gradually implemented since 2023, with 2025 marking the first year in which the Contracting Parties submitted GHG inventories, projections and integrated policies and measures under the adapted EU acquis. The following sections present information on GHG emissions, renewable energy and energy consumption, where available (EC, 2025i).

Box 3.3

How to make progress in climate and energy reporting: Ukraine case study ⁽¹⁸⁾

Ukraine is among the Energy Community Contracting Parties with the highest level of climate and energy reporting in 2025, having submitted 9 out of 11 reporting obligations – equivalent to 81.8% compliance. Despite Russia's ongoing war of aggression, Ukraine has made substantial efforts to develop and maintain a national reporting system for climate and energy data.

Ukraine identifies several strategic objectives for its reporting on climate and energy. Key national ambitions include:

- strengthening energy security;
- aiming for climate neutrality;
- progressing European integration;
- fulfilling international obligations;
- adapting to climate change.

Regular and high-quality reporting provides a reliable information base for public authorities to assess the effectiveness of policies, plan investments and additional measures and allow for data-driven decision making. Regular reporting also allows for monitoring progress towards national targets, including emission reductions, renewable energy development and energy efficiency improvements.

⁽¹⁷⁾ This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244/99.

⁽¹⁸⁾ This information is obtained through a dialogue between the EEA and the Ministries of Energy and Environment from Ukraine.

Box 3.3

How to make progress in climate and energy reporting: Ukraine case study (cont.)

In recent years, Ukraine has undertaken several key steps to strengthen its climate and energy reporting framework:

- Establishment of institutional arrangements for reporting: The Ministry of Economy of Ukraine has been designated as lead authority for implementing the NECP and for related progress reporting. Ministries, agencies and other implementing institutions have been given clear mandates to collect, analyse and submit data in the fields of climate and energy. An interdepartmental working group has been established, comprising representatives of all key ministries and agencies responsible for implementing the NECP policies and measures.
- Integration with European standards — Ukraine is gradually aligning its national legislation and practice with EU requirements, including the adapted Governance Regulation of the Energy Union, which forms part of the EU *acquis communautaire*.
- Development of monitoring and evaluation tools — the Ministry of Economy is preparing to launch an online platform to track the implementation and progress of all NECP policies and measures, thereby enhancing transparency and public accessibility.
- International cooperation — Ukraine continues to mobilise expert and financial support from international partners, particularly within the frameworks of the Energy Community and the EU.

With this comprehensive approach, Ukraine is determined to expand its reporting capacity, address existing challenges and advance its commitments under the Energy Community framework.

3.5.1 GHG emissions in other EEA member countries

GHG emission trends including emissions and removals via LULUCF have varied significantly among Iceland, Liechtenstein, Norway, Switzerland since 1990.

Iceland

Iceland aims to achieve climate neutrality before 2040 and to reduce GHG emissions by 40% from 1990 levels by 2030 (Iceland, 2023).

Under the Paris Agreement, each Party is required to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve.

Iceland's latest NDC, submitted in 2021, sets a goal to reduce net GHG emissions by 55% by 2030, 'to be achieved by acting jointly with the EU and its Member States and Norway' (Iceland, 2021). In 2023, Iceland's GHG emissions were 7% higher than in 1990, primarily due to industrial expansion over the interim period.

Norway

Norway submitted its updated NDC for 2035 in 2025, committing to reduce GHG emissions by at least 70-75% compared with 1990 levels. Norway also upholds its 2030 NDC, which aims for at least a 55% reduction in GHG emissions relative to 1990 levels (Norway, 2025).

Under the Climate Change Act, Norway has established a 2050 target to reduce GHG emissions by 90-95% compared with 1990 levels, with climate targets reviewed every five years (Norway, 2022). In 2023, Norway had reduced net GHG emissions by 23% below to 1990 levels. Excluding LULUCF, emissions were 9% lower than in 1990.

Liechtenstein

Liechtenstein submitted its second NDC in 2025, setting a 2035 target to reduce GHG emissions by at least 68% compared with 1990 levels. The country aims to achieve net zero emissions by 2050 (Liechtenstein, 2025). Liechtenstein's climate strategy, adopted in 2022, sets out the pathway towards climate neutrality by 2050. The strategy was updated in 2023 (Liechtenstein, 2023), raising the 2030 GHG reduction target from 50% to 55% below 1990 levels, as reflected in the second NDC.

Of this, 40% of emission reduction are to be achieved domestically, while 15% may be delivered abroad through international mechanisms.

Given the importance of the energy sector in Liechtenstein, the strategy includes reducing energy-related emissions by 50% by 2030, with the goal of eliminating emissions from this sector entirely by 2050. In 2022, Liechtenstein's GHG emissions were 22% lower than in 1990; data for 2023 were not available at the time of writing.

Switzerland

Switzerland updated its first NDC in 2021, revising its 2030 commitment from reducing emissions by 50% to reducing emissions by at least 50% compared with 1990 levels. The update also strengthened the 2050 indicative goal, moving from a 70-85% reduction to achieve net zero emissions (Switzerland, 2021). Switzerland's second NDC, submitted in 2025, covers the 2031-2035 period and sets a target to reduce GHG emissions by at least 65% compared with 1990 levels.

The 2050 net zero target remains in place and Switzerland plans to address hard-to-abate emissions through carbon capture and storage and carbon dioxide (CO₂) removal. After 2050, the volume of CO₂ removed through CDR is expected to exceed remaining GHG emissions (Switzerland, 2025). In 2023, Switzerland's overall GHG emissions, including removals via LULUCF, were 20% lower than in 1990.

Türkiye

Türkiye updated its first NDC in 2023, committing to reduce GHG emissions by 41% by 2030 compared with the business-as-usual scenario defined in its NDC, where 2012 serves as the base year. This represents an increase of 20% in ambition compared with the previous NDC.

Türkiye intends for emissions to peak by 2038 and aims to achieve a net zero emissions by 2053 (Türkiye, 2023). In 2023, Türkiye's net GHG emissions were

238% higher than in 1990. This increase reflects population growth, rising energy consumption and the dynamics of a rapidly growing economy.

3.5.2 GHG emissions in Energy Community Contracting Parties

Several Energy Community Contracting Parties have submitted their GHG inventories to the United Nations Framework Convention on Climate Change (UNFCCC) as part of their Biennial Transparency Reports (BTR). In 2025, for the first time, the Contracting Parties were also required to submit their inventories to the EEA, in line with the adapted EU Governance Regulation.

To date, six Contracting Parties — Ukraine, Serbia, Georgia, Albania, Montenegro and Moldova — have completed their submissions to the EEA. This represents a significant step forward in regional cooperation and in enhancing transparency in GHG reporting across the Energy Community framework.

Albania

Albania has submitted its revised NDC in 2021, expressing its mitigation target relative to a business-as-usual scenario (BAU). By 2030, Albania aims to reduce GHG emissions by 20.9% compared with projected BAU levels.

In its NDC scenario, the largest projected emission reduction compared with BAU in 2030 stems from the forest and land use sector (-68%), followed by the energy sector (-23%) (Albania, 2021).

In 2022, Albania's net GHG emissions were 28% lower than in 1990 (see Figure 3.10).

Bosnia and Herzegovina

Bosnia and Herzegovina's updated first NDC was submitted in 2021.

The country aims to reduce GHG emissions by 33.2% by 2030 compared with 1990 levels on an unconditional basis. With international support, Bosnia and Herzegovina would raise its ambition to a 36.8% reduction by 2030. For 2050, the country has set an unconditional reduction target of 61.7% and a conditional reduction target of 65.6% compared with 1990 levels (Bosnia and Herzegovina, 2021, 2023).

Its net GHG emissions in 2014 were 27% lower than in 1990.

Georgia

Georgia's first updated NDC, submitted in 2021, sets an unconditional target to reduce GHG emissions by 35% by 2030 compared with 1990 levels. With international

support, Georgia would increase this target to 50-57% (Georgia, 2022). In 2022, Georgia's net GHG emissions were 62% lower than in 1990.

Republic of Moldova

The Republic of Moldova submitted its third NDC in May 2025. The country's 2030 target is to reduce economy-wide net GHG emissions by 71% compared with 1990 levels, with an unconditional 2035 target of a 75% reduction. The country also aims to achieve climate neutrality by 2050 (Moldova, 2025).

In 2022, the Republic of Moldova's net GHG emissions were 69% lower than in 1990.

Montenegro

Montenegro submitted its updated NDC in 2025, committing to reduce net GHG emissions by at least 55% by 2030 and by 60% by 2035 compared with 1990 levels (Montenegro, 2025).

In 2023, Montenegro's net GHG emissions were 26% lower than in 1990.

North Macedonia

North Macedonia's first updated NDC, submitted in 2021, sets a target to reduce GHG emissions by 51% by 2030 compared with 1990 levels. This corresponds to a net GHG emission reduction of 82% compared with 1990 (North Macedonia, 2021, 2022).

In 2009, North Macedonia's net GHG emissions were 13% lower than in 1990.

Serbia

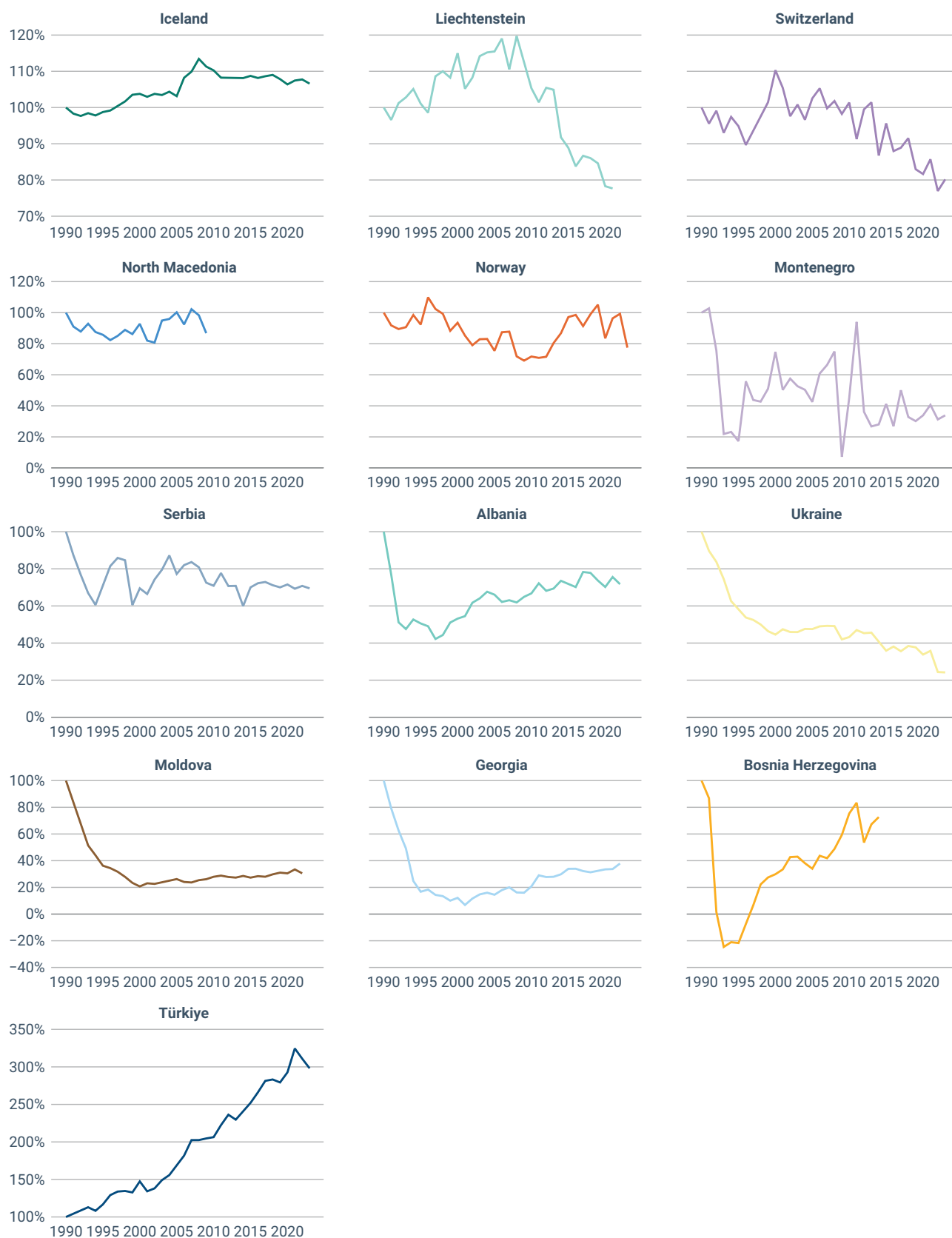
Serbia's NDC from 2022 sets its ambition for 2030 to an emission reduction of 33.3% compared to 1990 (Serbia, 2021, 2024). In September 2025, Serbia submitted its NDC up to 2035. It states a target of reducing GHG emissions in 2035 by 40.1% compared to 1990 (Serbia, 2025). Net GHG emissions in 2023 were 31% lower than in 1990.

Ukraine

Ukraine's first updated NDC, submitted in 2021, aims to reduce net domestic GHG emissions by 65% by 2030 compared with 1990 levels (Ukraine, 2021). In 2023, Ukraine's net GHG emissions were 76% lower than in 1990 (see Figure 3.10). Ukraine has been affected by Russia's war of aggression since 2022, which has also had impacts on its GHG emissions.

In 2021, Ukraine's net GHG emissions were 65% below 1990 levels.

Figure 3.10 Total GHG emissions trends in other EEA countries and Energy Community Contracting Parties



Source: Author's compilation based on data from EEA (forthcoming, 2025b), UNFCC (2025a, 2025b).

3.5.3 Renewable energy in other EEA countries

Renewable energy shares (RES) are available from Eurostat up to 2022 for Iceland and 2023 for Norway (see Table 3.1).

Both countries maintained high levels of renewable energy use throughout the period 2005-2022/3, starting from approximately 60% in 2005.

During the COVID-19 pandemic, renewable energy shares in both countries peaked before declining slightly in subsequent years. In 2023, Norway's renewable energy share stood at 76%.

RES for the Energy Community Contracting Parties are also available from Eurostat for all Parties except Ukraine (see Table 3.1). Among the Contracting Parties with available data up to 2015, Montenegro exhibited the highest share of renewable energy. From 2016 onwards, Albania recorded the largest share. In 2023, renewable energy shares among the Energy Community Contracting Parties ranged from 19% in Kosovo to 47% in Albania.

Table 3.1 Total renewable energy shares in Iceland, Norway and the Energy Community Contracting Parties

Country	2005	2010	2015	2020	2023
Iceland	60%	71%	72%	84%	
Norway	60%	62%	69%	77%	76%
Montenegro	36%	41%	43%	44%	41%
Serbia	14%	20%	22%	26%	25%
Albania	31%	32%	35%	45%	47%
North Macedonia	16%	16%	20%	19%	20%
Kosovo*	20%	18%	18%	24%	19%
Moldova	6%	21%	26%	25%	23%
Georgia					20%
Bosnia and Herzegovina			27%	40%	

Note: *This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Source: Author's compilation based on data from Eurostat (2025g).

3.5.4 Energy efficiency

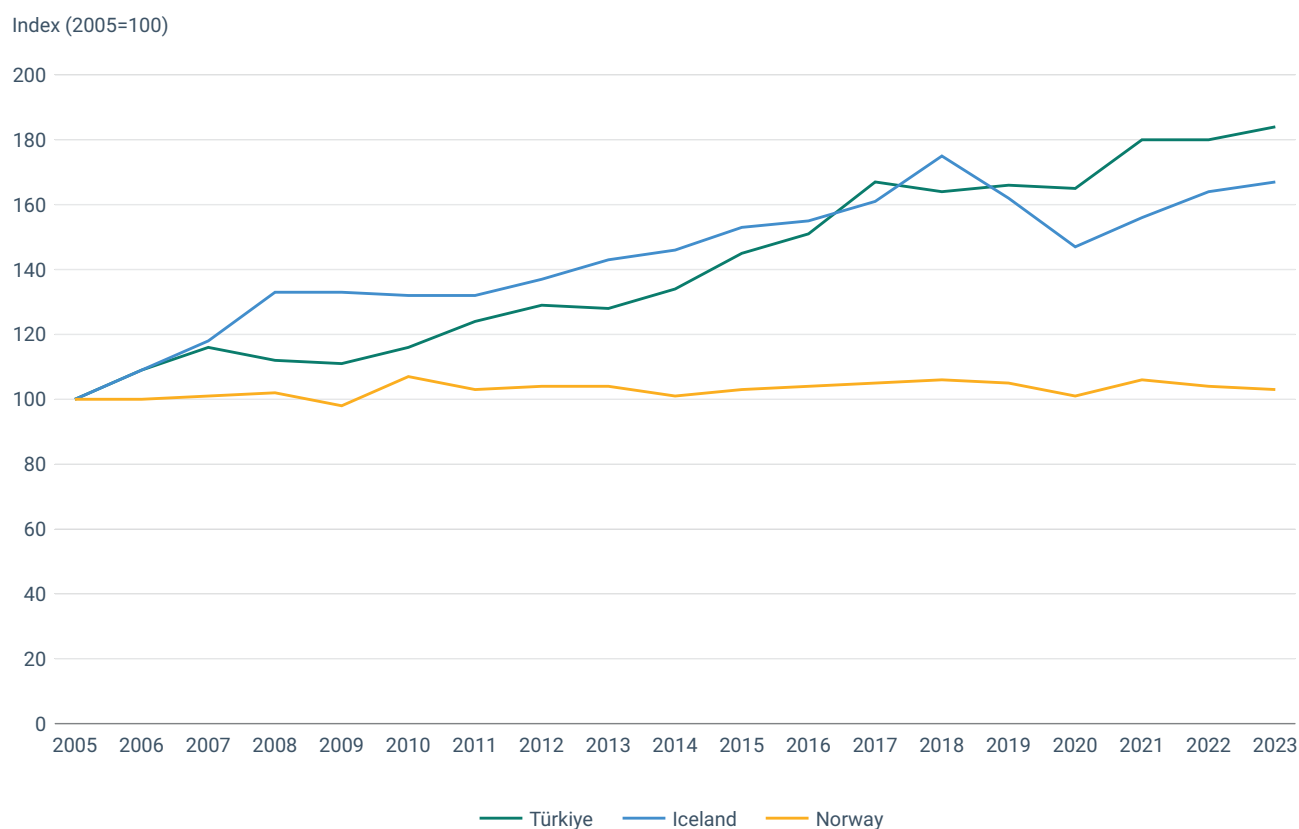
Information on final energy consumption is available for Iceland, Norway and Türkiye, covering the entire period since 2005 (see Figure 3.11).

Based on the latest data from Eurostat, between 2005 and 2023, final energy consumption increased significantly in Iceland and Türkiye – by 67% and 84%, respectively.

In contrast, Norway's final energy consumption rose modestly, by 3.3% over the same period.

Between 2022 and 2023, final energy consumption decreased in Norway by 0.9%, while increased by approximately 2% in both Iceland and Türkiye.

Figure 3.11 Final energy consumption compared with 2005 for other EEA countries



Note: This final energy consumption analysis follows the Eurostat methodology based on the definition laid out in Article 2 of the revised EED (FEC_EED).

Source: Author's compilation based on data from Eurostat (2025a).

Information on final energy consumption is available from Eurostat for eight of the nine Energy Community Contracting Parties, excluding Ukraine.

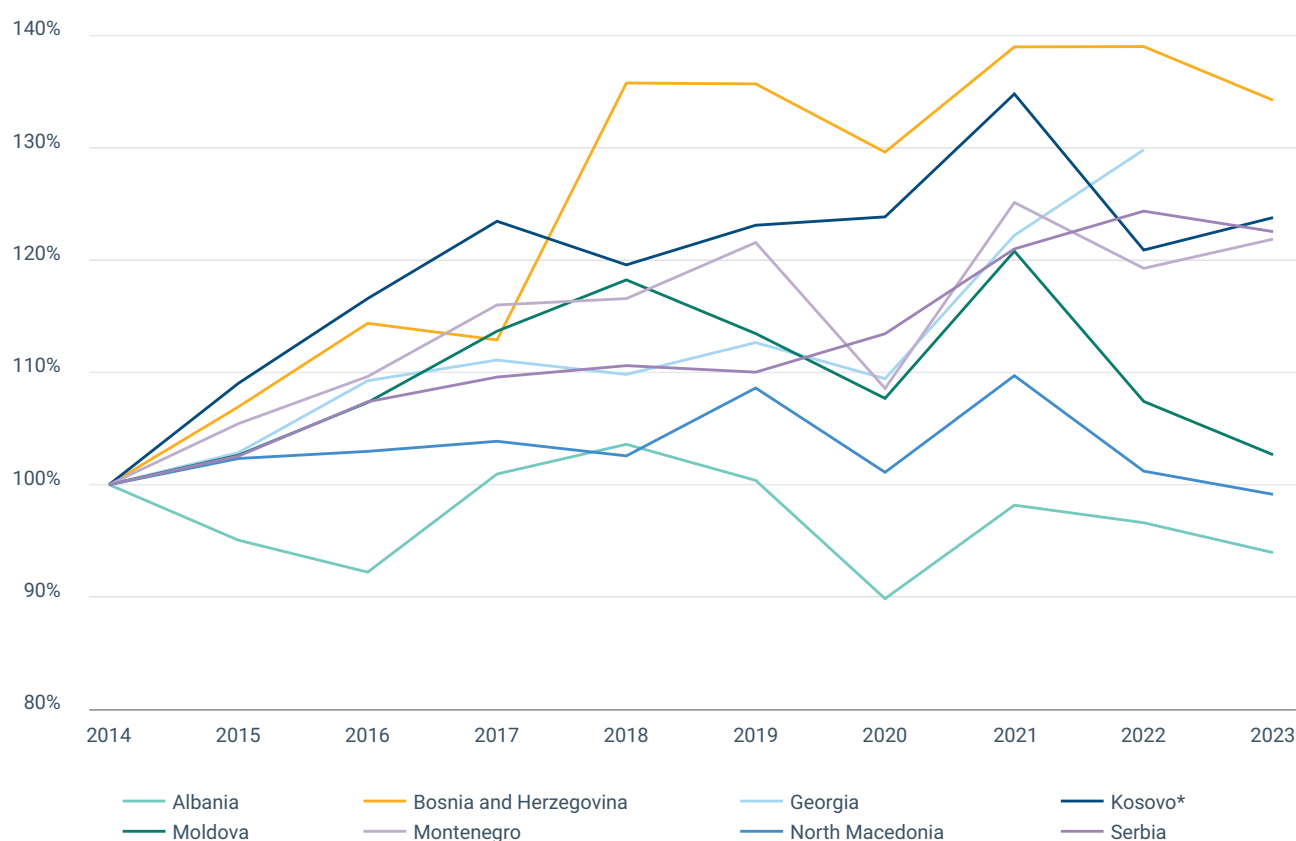
Figure 3.12 compares developments in final energy consumption across these eight Contracting Parties, starting in 2014 – the first year with data available for all parties – and shows indexed final energy consumption relative to the 2014 level.

Between 2014 and 2023, final energy consumption increased in all Contracting Parties except Albania and North Macedonia. For Georgia, 2023 data are not available.

The largest increase was observed in Bosnia and Herzegovina (+34%), followed by Kosovo (+24%) and Montenegro (+22%). By contrast, Albania and North Macedonia registered decreases of 6% and 1%, respectively, over the same period.

Between 2022 and 2023, final energy consumption decreased in Albania, Bosnia and Herzegovina, Moldova, North Macedonia and Serbia, while Kosovo and Montenegro recorded increases of approximately 2%.

Figure 3.12 Final energy consumption compared to 2014 for Energy Community Contracting Parties



Notes: This final energy consumption analysis follows the Eurostat methodology based on the definition laid out in Article 2 of the revised EED (FEC_EED).

*This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Source: Author's compilation based on data from Eurostat (2025a).

4 Conclusions and further steps

Climate action is delivering, but impacts are intensifying

The EU is in a decisive decade for climate action.

The findings of this report show that the EU has reduced its GHG emissions by more than one-third compared with 1990, while its economy has continued to grow substantially. Renewable energy now supplies a quarter of gross final energy consumption and almost half of electricity, while final energy demand has declined.

These developments demonstrate that climate action is delivering and that structural change towards a clean transition is well underway.

However, the reality is increasingly sobering as climate impacts intensify. The year 2024 was the warmest on record in Europe, with heatwaves, droughts, wildfires and floods affecting people's lives, ecosystems and economies. These events underscore both the urgency of sustained action and the rising costs of inaction and delay.

The pace of Europe's GHG emission reductions has accelerated over recent decades, with the average annual reduction over the past five years being significantly higher than in earlier periods. Maintaining this pace is essential to achieve the EU's 2030 climate target and to get on track towards climate neutrality by 2050.

Projections submitted by Member States in 2025 indicate a net emission reduction of 54% by 2030, bringing the EU close to its 55% target, provided that existing and planned measures are swiftly and effectively implemented. At the same time, progress has slowed in several sectors and Member States.

Transport has surpassed energy supply as the largest source of emissions, removals from LULUCF have declined and energy savings remain insufficient to meet 2030 efficiency targets. These gaps highlight the need for a renewed focus on implementation and for greater efforts to accelerate the enablers of the transition — including technology deployment, policy coherence and societal engagement.

Sectoral transformation and Member States' contributions are uneven

The energy supply sector has halved its emissions since 2005, driven by the expansion of renewable energy and improvements in energy efficiency.

The industrial sector has achieved steady emission reductions, mainly through process improvements and enhanced energy efficiency, demonstrating that competitiveness and climate can advance together. However, the deployment of zero carbon technologies remains essential for deep decarbonisation.

In buildings, emissions have declined by more than one-third since 2005, reflecting both the improved energy performance of the existing building stock and stricter energy efficiency standards for new constructions. Nonetheless, a faster rate of building renovations is needed to meet future targets.

Transport remains the most challenging sector. Although the GHG intensity of new vehicles has declined, persistent high transport demand continues to offset efficiency gains and hinder decarbonisation.

Agriculture shows only limited emission reductions, while the CO₂ removal capacity of Europe's forests and soils has declined significantly — a trend that must be urgently reversed. International transport also presents concerning developments: international aviation emissions more than doubled between 1990 and 2019 and have since rebounded to near pre-pandemic levels following the temporary drop in 2020. International shipping have risen by over 25% compared with 1990, although they have stabilised in recent years.

These patterns confirm that while some sectors are transforming rapidly, others must accelerate — or even reverse — their current trends.

At the EU level, overall progress masks wide national differences. Some Member States are already nearing climate neutrality, while others lag behind in emission reductions, renewable energy deployment or energy savings.

The updated NECPs are central to closing these gaps by aligning national actions with EU-wide targets. In 2023, most Member States were on track towards their national targets under the ESR, though several exceeded their annual emission allocations.

With strengthened ESR targets applying from 2024, Member States must intensify their efforts to remain within annual emission limits in the coming years.

Reported LULUCF data shows declining removals in many Member States, mirroring the EU-wide trend. Stronger national action, combined with EU-level support and cooperation, is key to ensuring that all Member States contribute fairly and effectively to the common EU climate and energy targets.

The transition strengthens resilience and security

The EU's energy and industrial transitions, as envisioned under the new Clean Industrial Deal, are not only a climate imperative but also a strategic necessity.

Phasing out fossil fuels reduces dependence on costly imports, enhances resilience to geopolitical tensions and lowers energy costs for households and industry. At the same time, scaling up clean technologies is essential to Europe's long-term industrial competitiveness.

The coming years will be critical, presenting a unique opportunity to align climate neutrality with economic and security objectives, particularly amid continued geopolitical instability and elevated energy prices.

Implementation is the priority for 2030

With the major legislative framework for 2030 in place, attention must turn decisively to implementation.

The period leading up to 2030 must sustain the accelerated deployment of renewable energy efficiency improvements, electrification and clean technology innovation, while also reversing the decline in carbon removals.

Thousands of national measures have been reported in Member States' NECPs, but their impact depends on timely and full implementation. Equal focus must be placed on the enabling conditions — including stable investment frameworks, the removal of unnecessary market barriers and support for communities and public acceptance. Together, these factors will determine Europe's ability to meet its climate goals, achieve a sustainable, competitive and sovereign economy and shape its future trajectory.

Looking ahead towards 2040 and beyond

On 5 November, the European environment ministers have formally agreed a 90% reduction in GHG emissions by 2040 compared to 1990. Achieving this milestone would place the EU firmly on track towards climate neutrality by 2050.

This report shows that the foundation for this progress is in place: recent years have seen a rapid acceleration in emission reductions and the emergence of numerous technological and policy solutions. However, it also underscores the scale of the remaining challenge — in particular, the need to strengthen carbon sinks, accelerate transport decarbonisation and enhance delivery at national level.

Amid intensifying climate impacts, public concern remains high, yet support for EU climate policy continues to be strong, as confirmed by the recent Eurobarometer survey.

Every tonne of emissions avoided reduces future risks and costs. Every renewable installation, building renovation or EV deployed represents a step towards a cleaner and more resilient Europe.

The *Trends and projections in Europe* report reaffirms that the EU is capable of achieving its long-term climate goals — but it is critical that the momentum of the past five years is maintained and accelerated.

Abbreviations

AEA	Annual emission allocation
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
BAU	Business-as-usual scenario
BTR	Biennial transparency reports
CAP	Common agricultural policy
CBAM	Carbon Boarder Adjustment Mechanism
CCUS	Carbon capture, utilisation and storage
CHP	Combined heat and power
CH ₄	Methane
CO ₂	Carbon dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
EC	European Commission
ECL	European Climate Law
EEA	European Environment Agency
EED	Energy Efficiency Directive
EEX	European Energy Exchange
Eionet	European Environment Information and Observation Network
ESR	Effort Sharing Regulation
ETC CME	European Topic Centre on Climate Change Mitigation and Energy
ETS	Emissions Trading System
EU	European Union
EUA	EU allowance
EU-27	27 Member States of the European Union (post-Brexit)
EV	Electric vehicle
FEC	Final energy consumption
GDP	Gross domestic product
GHG	Greenhouse gas

GT	Gross tonnage
GVA	Gross value added
IDEES	Integrated Database of the European Energy System
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
LRF	Linear Reduction Factor
Mtoe	Million tonnes of oil equivalent
LULUCF	Land use, land use change and forestry
MSR	Market stability reserve
MtCO ₂ e	Million tonnes of CO ₂ equivalent
Mtoe	Million tonnes of oil equivalent
NDC	Nationally determined contribution
NECP	National energy and climate plan
NFI	National forest inventories
N ₂ O	Nitrous oxide
PEC	Primary energy consumption
PFC	Perfluorocarbon
RED	Renewable Energy Directive
RED II	Recast Renewable Energy Directive
RES	Renewable energy share
SAF	Sustainable aviation fuel
SCF	Social Climate Fund
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value-added tax
WAM	With additional measures
WEM	With existing measures

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