European Environment Agency

Trends and projections in Europe 2024

EEA Report 11/2024

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Luxembourg: Publications Office of the European Union, 2024

ISBN 978-92-9480-685-7
ISSN 1977-8449
doi:10.2800/7574066

Cover design: EEA
Cover photo: © Pixabay
Layout: Eworx/EEA

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About this report and its scope

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 EU Member States, five EEA member countries and nine contracting parties of the energy community.

The report is accompanied by a technical background document that describes in more detail the data sources and targets mentioned in this report.

Throughout the report, the following scope is used, unless otherwise noted:

- References to the EU relate to the EU-27;
- Projections are those reported by countries in 2023 and updated in 2024 under Article 18 of the Regulation (2018/1999) on the Governance of the Energy Union and Climate Action;
- Global warming potentials from the UN's *Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (AR5) are used to represent greenhouse gas emissions.

Acknowledgements

The European Environment Agency (EEA) would like to thank the European Topic Centre on Climate Mitigation (ETC CM) for its help in preparing this report. National Focal Points and EEA member country experts, as well as the European Commission, are also thanked for their valuable contributions and input.

In particular, the EEA would like to acknowledge the primary authors, Sabine Gores, Hannah Förster (both Öko-Institut) and Nele Renders (Vito).

Executive summary

Climate and energy progress in Europe: record annual emissions reduction marks significant step towards the 2030 climate target

Climate change is affecting the planet in many ways: extreme heat and changing rainfall patterns are reshaping the physical environment and are also impacting people's food and water security, energy supply, financial stability and health. Over the past year, global temperatures have consistently exceeded the 1.5°C threshold (Copernicus Climate Change Service, 2024), approaching the level of the 1.5°C long-term target set by the Paris agreement. Europe is the world's fastest-warming continent, which poses significant climate risks to the well-being of citizens across Europe, as shown earlier this year in the EU's first climate risk assessment (EEA, 2024c). These findings underscore the urgent need to improve societal preparedness and enhance resilience to climate change.

Alongside the need to rapidly adapt to the changing climate, the accelerating pace of climate change highlights the imperative to reduce greenhouse gas (GHG) emissions. Since 1990, global GHG emissions have risen by more than 60%. In contrast to this global development, the EU has demonstrated that it is possible to cut emissions by over one third while maintaining economic growth. Together, the EU countries are committed to become climate neutral by 2050 at the latest and aim to achieve negative emissions thereafter. This report provides an overview of Europe's progress towards this goal with a focus on progress to the EU's intermediate 2030 climate and energy targets. The analysis is based on the most recent data reported by Member States following the adoption of the Fit for 55 legislative package and verified by the European Environment Agency (EEA), as well as other sources.

In 2023, EU total net GHG emissions decreased to 37% below 1990 levels compared to a 31% decrease in 2022, according to preliminary figures. This estimate is based on Member State reports and applies the EU climate target scope as defined in the European Climate Law (EU, 2021), including net removals from the land use, land use change and forestry (LULUCF) sector as well as emissions from international aviation and maritime transport activities regulated under EU law. The emissions reduction in 2023 represents the largest year-on-year reduction in several decades, if 2020 is excluded due to the impact of COVID-19.

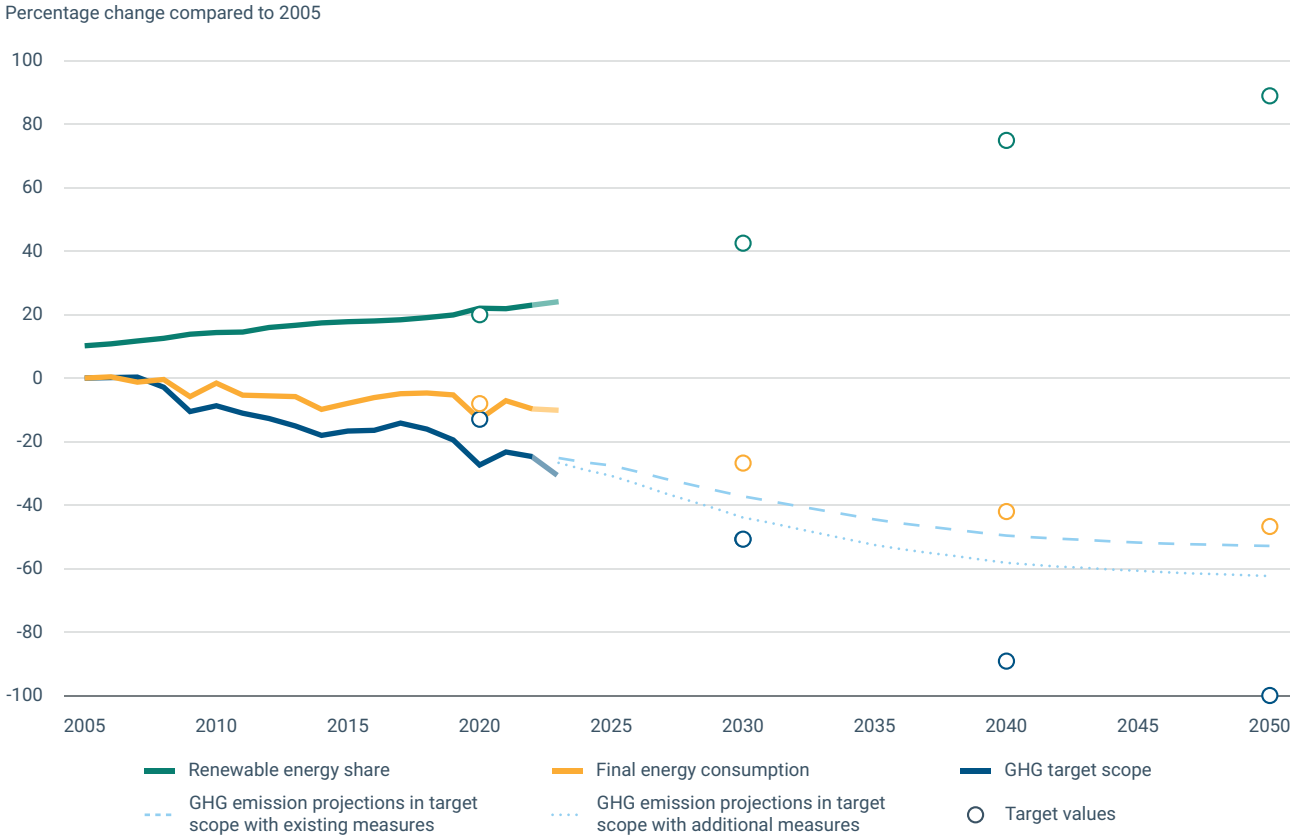
Since 1990, Europe's reduced use of fossil fuels, and coal in particular, has been the largest driver of GHG emissions reductions. In 2023, this remained a dominant factor. The accelerating decarbonisation of the European economy has only been possible due to the rapid expansion of renewable energy. According to the EEA's early estimates, the share of renewable energy had grown from 10.2% in 2005 to an estimated 24% of the EU's gross final energy consumption by 2023. Further, the EU has managed to continue reducing its energy consumption. According to early estimates for 2023, primary energy use has fallen by 19% since 2005, while final energy consumption fell by 11% during the same period.

These developments mark significant progress towards climate neutrality for the EU, with the pace of emissions reductions accelerating in recent years. The yearly reduction witnessed in 2023 is more than three times the average rate since 2005 and surpasses the annual rate required to meet the 2030 climate targets. However, challenges remain. Based on the policies and measures currently in place across Europe, Member States project a joint reduction in net emission levels of 43% by 2030 compared to 1990. Adding currently planned additional measures, the projected GHG emission reduction as reported under the Governance Regulation rises to 49%, still leaving a gap of six percentage points to the 2030 climate target. If only the EU domestic GHGs are taken into account (excluding international transport), GHG emissions are projected to reduce by 51% by 2030. Updates to national energy and climate plans (NECPs) offer an opportunity to implement additional measures to bridge the gap towards the target. An initial European Commission assessment of the plans submitted at the time of drafting this report confirm an increased collective ambition level towards 2030, reducing the gap to the EU’s 2030 target of 55%.

For 2040 and 2050, these projections reveal a widening gap between the aggregated national expected emissions and the EU targets. They also indicate the importance of the continued development of new, extended and expanded policies and measures to ensure emissions reductions can deliver climate neutrality in only two and a half decades.

Additional policies and measures to further support the transition of Europe's energy system are similarly critical. These are the key components needed to reach climate neutrality and to support other policy objectives, such as reducing the EU's dependency on energy imports. Meanwhile, the share of EU gross final energy consumption generated by renewable sources — the so-called renewable energy share — has grown by an average of 0.8% per year since 2005. This pace needs to triple by 2030 to meet the targets. Also, regarding energy efficiency, acceleration is needed to achieve the objectives. For primary energy consumption, the average reduction over the coming years must more than double compared to the average yearly reduction in energy consumption since 2005. For final energy consumption, the average annual effort must more than triple compared to the same period.

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



Notes: This figure presents the progress of the EU's headline targets since 2005: reducing greenhouse gas emissions, increasing the renewable energy share and improving energy efficiency. In this figure, the EU's total net greenhouse gas emissions include all GHG emissions and removals regulated by EU law (see Box 1.1). The data for 2005-2022 are from Eurostat (2024d), Eurostat (2024b), and EEA (2024a), while the 2023 values are estimated by the EEA. The aggregated GHG emissions projections are based on the data submitted by Member States in 2024 under Article 18 of the Governance Regulation. The reference points for 2030 refer to the targets outlined in the 2030 legislative framework (EU, 2023b, 2023c, 2021). For greenhouse gases, the reduction in 2040 relates to the recommendation in EC (2024c) 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: Eurostat, 2024b, 2024d; EEA, 2024a, forthcoming b, forthcoming g.

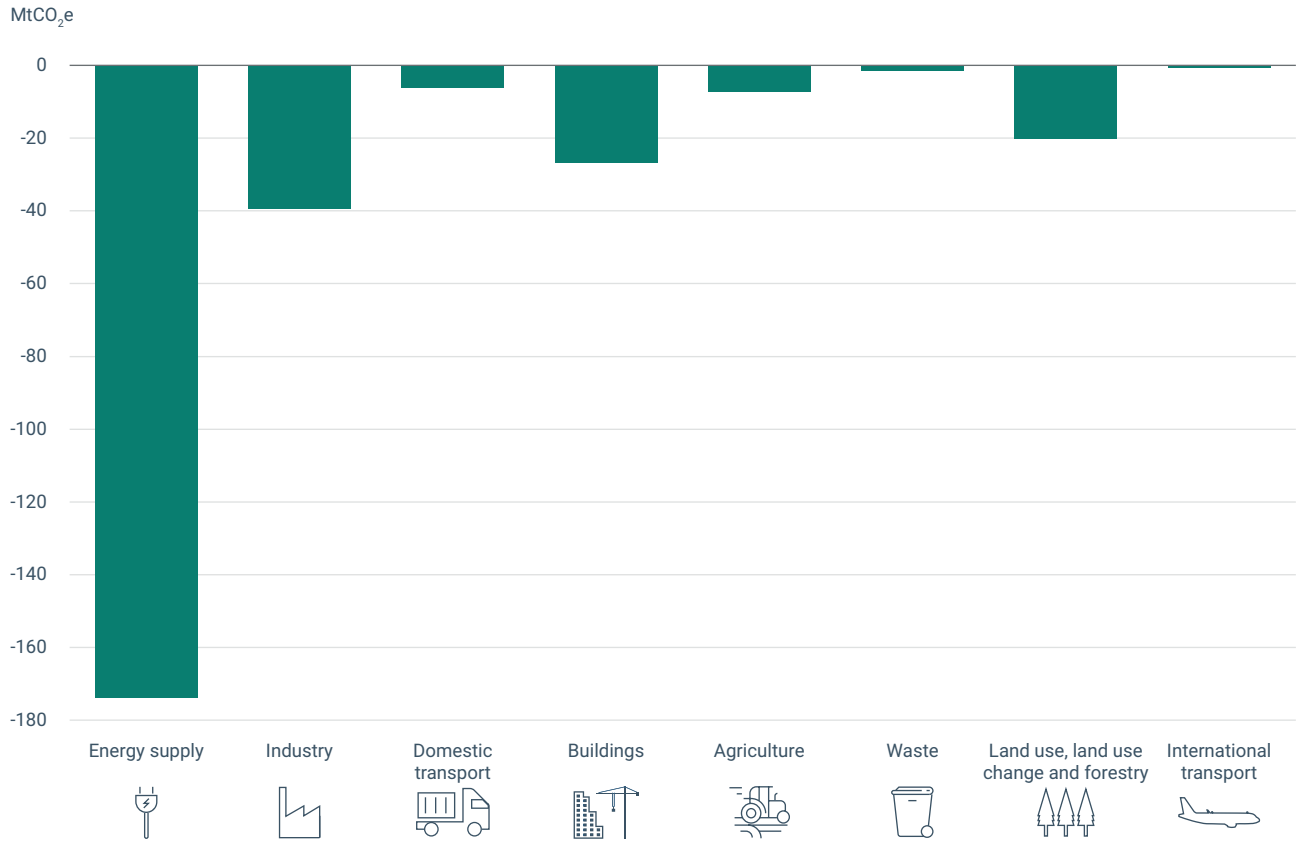
Spectacular emissions reductions in energy sector

Europe's emissions reductions vary across its economic sectors. In the energy supply sector, emissions have nearly halved compared to 2005 levels. The fall was driven by a significant decline in coal usage and growth in the use of renewable energy sources. The industrial sector has also seen significant reductions of more than a third over the last two decades thanks to process improvements and efficiency gains. These two sectors make up the bulk of Europe's current cap-and-trade system — the Emissions Trading System (ETS) (EU, 2023b) — which brings the 2030 emissions reduction target for ETS within reach.

However, the situation is different for the sectors covered by the Effort Sharing Regulation (ESR) (EU, 2023g), which has national reduction targets. These mainly include emissions from buildings, transport, waste and agriculture. While the buildings sector has achieved a notable reduction in emissions — with a drop of over 30% since 2005 — the transport sector has shown little progress (-5% in 2022 compared to 2005). Even with the increasing adoption of electric vehicles in recent years, the slow pace of emission reductions has resulted in transport becoming the largest source of emissions in the EU. Agriculture has also experienced slower emissions reductions since 2005 compared to other sectors.

As a result, the overall decline in emissions covered by the ESR is progressing slower than the sectors covered by the ETS. The introduction of a new ETS system (ETS2), which will take effect in 2027, will incentivise further reductions in emissions from the transport and building sectors. However, it is clear that several Member States must also implement supporting measures to drive faster progress in the sectors covered by the ESR. The same applies to the LULUCF sector: the GHG sink capacity in the EU has sharply declined since 2010 and must be reversed by 2030 to meet the target.

Figure ES.2 EU GHG emission reductions across sectors: 2022 vs 2023



Notes: This figure presents the emissions reductions of each sector in 2023 compared to 2022, expressed in million tonnes of CO_2 equivalent (Mt CO_2e). 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 reported under memo items.

Mt CO_2e, million tonnes of CO_2 equivalent.

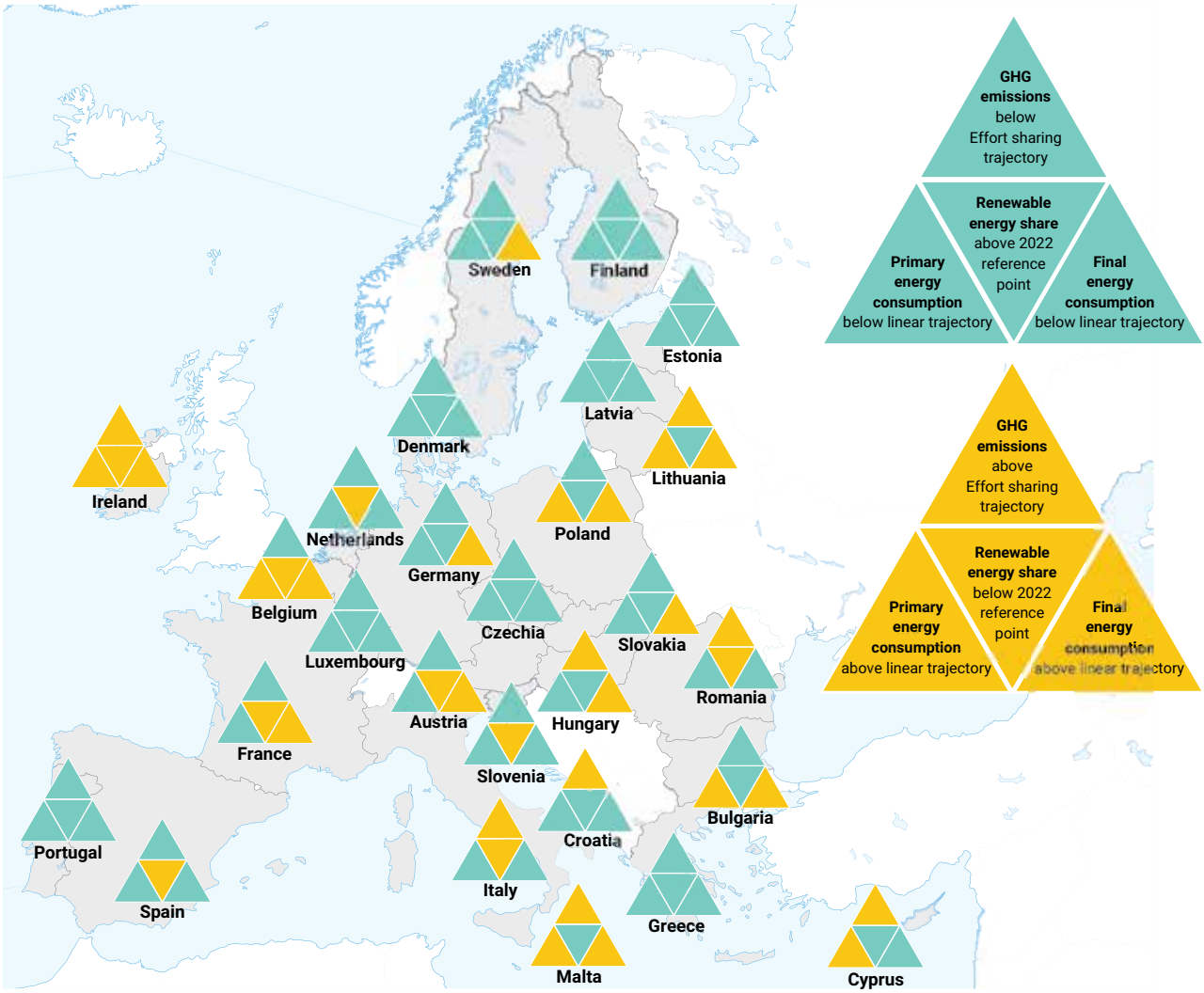
Sources: EEA 2024a, forthcoming e.

The estimates for 2023 suggest an acceleration of historical trends. Between 2022 and 2023, the energy supply sector's GHG emissions fell by an estimated 19% year-on-year. This decline was primarily driven by a substantial increase in renewable energy production, with a smaller contribution from a reduction in overall energy consumption in 2023. As a result, the energy supply sector has taken a significant step towards climate neutrality and is responsible for the lion's share of emissions reductions in 2023. In the industrial sector, there has also been a notable reduction in emissions (-6%), although in some subsectors declining production levels indicate that part of this drop can be attributed to lower industrial output in Europe ([1]). This observation highlights the importance of the Green Deal industrial plan to enhance the competitiveness of Europe's net-zero industry and supports the fast transition to climate neutrality. The domestic transport sector registered a modest 1% decline in emissions for 2023, with electric vehicle adoption growing more slowly than in previous years. In contrast, the building sector is estimated to have achieved a 6% reduction in emissions in 2023, while in agriculture emissions are anticipated to have decreased by around 2%.

([1]) Evidence is not yet strong enough to fully understand the underlying changes in manufacturing activities as the sector is sensitive to ongoing changes in commodity markets. The EEA will launch a study on this topic in the coming year in the context of the new green industry policy.

Member States need to step up efforts to reach 2030 targets

Figure ES.3 Assessing Member States' 2022 climate and energy performance



Notes: This figure illustrates the 2022 climate and energy performance of Member States. For GHG emissions, it compares 2022 GHG emissions under the ESR with the available annual emission allocation (AEA) for 2022. This is a first step towards the assessment of 2022 progress, given that Member States have flexibilities under the ESR to match the AEA with its emissions. For primary and final energy consumption, it compares the national energy consumption in 2022 with a 2022 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 2019. For renewable energy it compares the 2022 renewable energy share with the interim trajectory share 2022 reference point under the Governance Regulation. The ESR emissions for Croatia relate to the corrected version submitted in April 2024.

Sources: EEA 2024c; EU, 2023a; Eurostat 2024b, 2024d; EC, 2020b.

The EU's policy framework has established a comprehensive system that supports Member States in contributing towards the EU's climate neutrality target by 2050 at the latest.

For climate mitigation targets, an increasing number of countries are falling behind on their trajectories under the ESR. In 2022, in eight Member States the GHG emissions covered by the ESR were above their annual emission allocations (AEAs). This indicates that these Member States will have to make use of the flexibilities available under the legislative framework to comply with their annual emission limits. At the same time, the share of renewable energy in 2022 remained below the baseline set by the 2020 renewable energy target for Austria, France and Ireland. This means that these Member States will have to take additional measures to cover the gap within an additional year.

Five additional countries had 2022 renewable energy shares that were below their 2022 reference points, as set based on the previously EU-level agreed target before the entry into force of the revised Renewable Energy Directive. In relation to energy efficiency, most Member States need to step up efforts. Based on a linear trajectory between the 2020 target and the 2030 contribution — as set by the Member States in their national energy and climate plans (NECPs) submitted in 2019 — seven Member States are lagging on the path towards their 2030 primary energy consumption contributions and 12 are on a trajectory towards their final energy consumption contribution. Given the tightening of renewable energy and energy consumption national 2030 contributions in the updated NECPs, Member States should intensify efforts.

Sustained efforts needed towards 2030 and beyond

These latest developments highlight the need for sustained efforts to reduce emissions across the EU and to make progress towards climate neutrality. With the major legislative framework for 2030 now in place, attention can shift to implementation and achieving the targets. Member States hold crucial levers to steer policy in the right direction and the update of the NECPs is contributing to clear national policy frameworks across all dimensions of the Energy Union. Success in certain sectors, such as energy supply, accompanied by the rapid transition in specific countries, demonstrates that significant emissions reductions are achievable. On the other hand, maintaining momentum towards climate neutrality will require a clear and predictable policy framework beyond 2030 — not least, an agreement on the recommended 90% reduction target for 2040 and an assurance of sufficient investment for the net-zero emission economy of the future.

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1 Greenhouse gas emissions and energy trends in the EU

Key messages

- In recent decades, the EU-27 has reduced net emissions of greenhouse gases (GHG) while simultaneously fostering economic prosperity. In 2022, net GHG emissions had decreased by 31% compared to 1990 levels, with renewable energy sources contributing a substantial 23% to the energy mix. The EU's commitment to energy efficiency resulted in a reduction in energy consumption in 2022 compared with 2005, both for primary energy (-16%) and for final energy (-10%).

- In 2023, GHG emissions in the EU fell by 8% compared to 2022 according to estimates reported by Member States and compiled and quality-checked by the EEA. This marks the largest year-on-year emission reduction in several decades, except for the COVID-impacted year of 2020, and brings estimated 2023 emissions to a level of 37% below 1990 levels. Aligned with this significant emissions reduction, estimates indicate that Europe successfully reduced its energy consumption in 2023 compared to 2022. The EU's primary energy consumption is estimated to have dropped by 4% while final energy consumption fell by an estimated 2%. The share of renewable energy in the EU's total energy consumption is projected to have increased to 24%, mainly through a significant increase in renewable electricity production and a reduction in final energy demand.

- The vast majority of the GHG emissions reductions in 2023 occurred within the energy supply sector and industry, both of which are covered by the Emissions Trading System (ETS). This was driven primarily by the continued rollout of renewable electricity production and a combination of reduced output and efficiency gains in industrial sectors. By contrast the sectors covered by the Effort Sharing Regulation (ESR), which are subject to national emissions reduction targets, had more limited reductions according to the estimates. A modest progress towards the 2030 net removal target is estimated for the land use, land use change and forestry (LULUCF) sector.

- To realise the EU's climate and energy targets for 2030, as part of the trajectory towards achieving climate neutrality at the latest by 2050, an acceleration of efforts will be needed. The significant emissions reductions in 2023 mark a major step towards the overall 2030 climate target. However, emissions reductions by the effort sharing sector, and increasing net removals in the LULUCF sector, must accelerate. For the final energy consumption sector and the share of renewable energy in the energy mix, annual efforts must more than triple compared to the period 2005-2022.

- Current and planned policy measures across Europe are expected to help achieve the required acceleration. Member States reported that that the policies and measures they currently have in place, or that are under preparation, will achieve a reduction of net GHG emissions (including international aviation and maritime regulated under Union Law) of 49% in net emission levels by 2030 compared to 1990 (51% for domestic GHGs). The ongoing cycle of updates to national energy and climate plans (NECPs) offers an opportunity to implement additional measures to bridge the gap towards the target. An initial European Commission assessment of the plans submitted at the time of drafting this report confirm an increased collective ambition level towards 2030, reducing the gap to the EU's 2030 target of 55%.

1.1 Introduction

Climate change is accelerating rapidly. The global average temperature is the highest on record, with the past 12 months being 1.58°C above pre-industrial levels (Copernicus Climate Change Service, 2024), and is approaching the 1.5°C long-term target set by the UN's Paris Agreement on climate change. According to the recent European climate risk assessment (EEA, 2024c), Europe is the fastest warming continent in the world. Europe is warming twice as fast as the global average, with climate risks threatening its energy and food security, ecosystems, infrastructure, water resources, financial stability and people's health. Many of these risks have already reached critical levels and could become catastrophic without urgent and decisive action. These findings stress the importance of enhancing societal readiness to confront these risks effectively.

At the same time, the accelerating pace of climate change underscores the imperative to reduce GHG emissions. Despite widespread recognition of global warming for many decades, global GHG emissions continue on an upward trajectory (Crippa et al., 2024). To reverse this trend, global action is essential, including a rapid phasing out of fossil fuels and a substantial transition across all sectors.

To reduce its emissions in line with commitments to the Paris Agreement, the EU has embarked on a path towards climate neutrality. The European Climate Law (EU, 2021) sets a binding target for the EU to achieve climate neutrality by 2050 at the latest. The law also sets a binding mid-term target for the EU to reduce net GHG emissions by at least 55% by 2030 compared to 1990.

In addition, in February 2024 the European Commission recommended a 90% net GHG emissions reduction by 2040 compared to 1990 levels to serve as the next important stepping stone towards achieving net zero emissions by 2050 (EC, 2024c). The 90% recommendation reflects the minimum target level for 2040 recommended by the European Scientific Advisory Board on Climate Change (European Scientific Advisory Board on Climate Change, 2023). The current 2030 climate target is implemented through a robust legal framework, which includes binding GHG emissions reduction and removal targets for Member States, a Europe-wide cap-and-trade system (ETS), a detailed climate and energy governance framework and a comprehensive set of supplementary legislation addressing diverse sectors.

This report monitors progress towards the 2030 climate and energy targets and also looks beyond 2030 to climate neutrality. The assessments included in the report are based on key data sources that can be categorised as historical data (1990-2022), preliminary 2023 data and future evolutions.

Historical data (1990-2022):

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

Preliminary 2023 data:

- Approximated 2023 GHG emissions reported by Member States
- Estimated 2023 energy consumption and renewable energy data from the EEA and its European Topic Centre on Climate Change Mitigation (ETC CM)

Future evolutions:

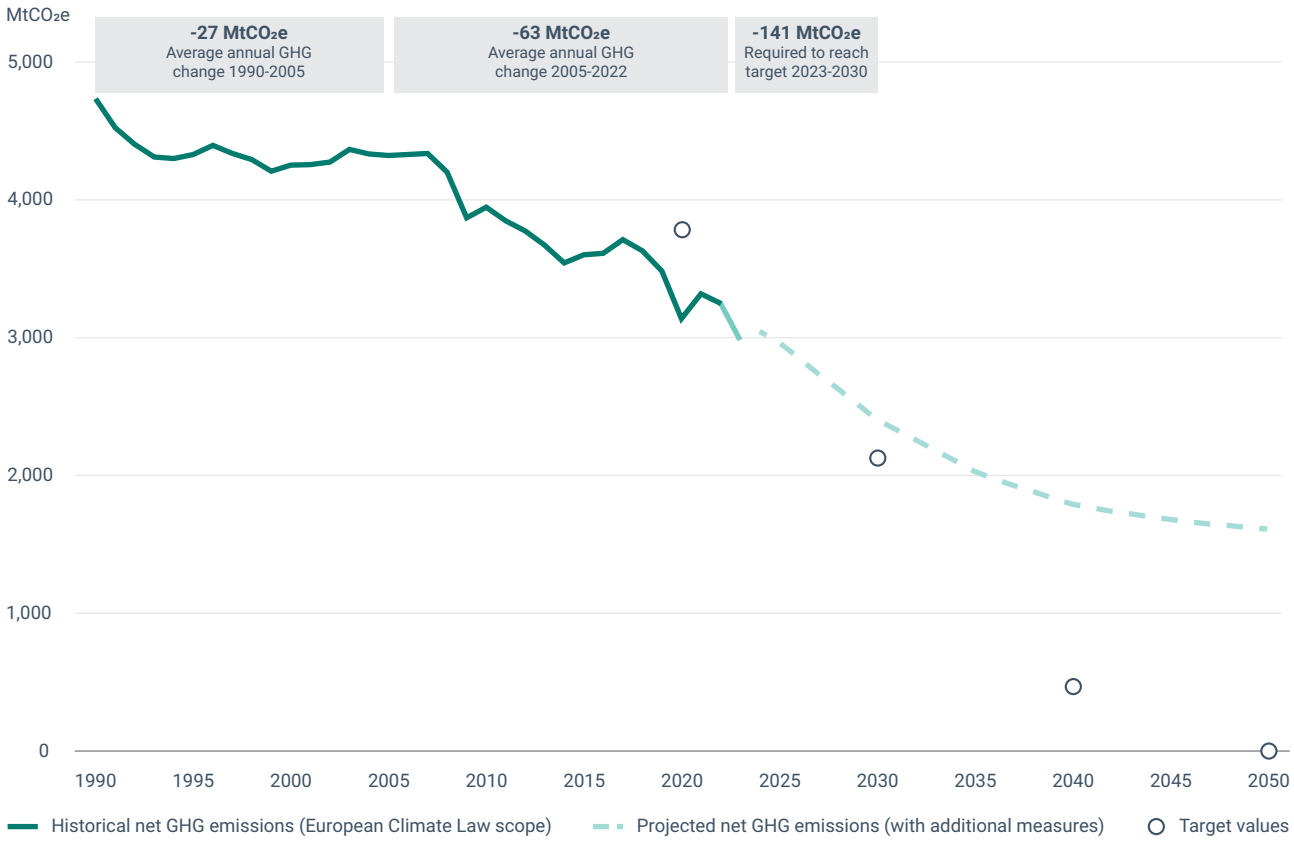
- 2023-2050 projected GHG emissions as reported by Member States under the Governance of the Energy Union and Climate Action Regulation (Governance Regulation)
- 2030 contributions for energy consumption and renewable energy as included in Member States' NECPs

Since June 2024, Member States have been submitting updates of their NECPs to the European Commission, outlining their main targets, ambitions and policies across the various dimensions of the Energy Union. Following the draft versions that were evaluated by the Commission in December 2023 (EC, 2023a), the final updated plans will be assessed by the Commission. The updated plans were not taken into account in this report's assessment.

1.2 Progress to 2030 headline targets

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 by EU law (see Box 1.1). The estimation of historical emissions from the international aviation and maritime sectors for this scope relies on data derived from the Joint Research Centre's IDEES methodology (calculated based on JRC (2024a, 2024b). The target values are derived from the European Climate Law for 2030 and 2050 (EU, 2021) while for 2040 the -90% target as recommended by the European Commission (EC (2024c) is visualised by applying the percentage reductions to the calculated 1990 baseline figures. The data for the 1990-2022 period are from EEA (2024a), while the 2023 values are from EEA (forthcoming f). The aggregated GHG emissions projections are based on the data submitted by Member States in 2024 under Article 18 of the Governance Regulation, taking into account planned additional measures ('WAM-scenario').

Sources: EEA calculations based on EEA, forthcoming d; EC, 2024c; JRC, 2024a,b.

Preliminary estimates for 2023 are based on the approximated GHG inventories submitted by Member States and indicate that EU-wide GHG emissions have decreased by 8% compared to 2022 within the scope of the European Climate Law. This significant reduction over the course of a year is largely driven by decreases in emissions from the power sector, with additional reductions in the industry and buildings sectors. In absolute terms, the overall 8% decrease represents a reduction of 270 million tonnes of CO_2 equivalent (Mt CO_2e), more than four times the average annual decrease reported since 2005. When compared to the 2030 target, the emissions reductions are substantial. Comparing 2022 emissions with the 2030 target, an average annual emissions reduction of 141Mt is required. The reduction achieved in 2023 is nearly twice as high. This marks the largest year-on-year drop in

GHG emissions in recent decades, except for 2020, when emissions were influenced by the COVID-19 pandemic. The 2023 reduction continues the trend of decreasing emissions observed since 2018.

The overall year-on-year reduction translates to an estimated net GHG emissions level for 2023 that is 37% below the 1990 level. By comparison, the level achieved in 2022 was 31% below the 1990 level. With this, the EU continues its sharp decline in GHG emissions, marking an important step towards achieving a net 55% reduction by 2030. To close the remaining gap by 2030, it is essential that emissions reductions continue at a swift pace over the coming years.

Member States' GHG projections ([2]) submitted in 2023 and updated in 2024 indicate that additional efforts must be made. Based on existing measures alone, the projections forecast a reduction in net GHG emissions by 2030 to a level 43% below 1990 levels. However, 22 Member States have also submitted additional projections that consider additional planned but not-yet-launched measures. When these additional measures are included, net GHG emissions in 2030 are projected to reach 49% below 1990 levels in the EU (domestic GHGs are projected to reduce by 51%). Additional measures outlined by Member States in their NECPs, which will be evaluated at the end of the year, and the continued implementation of the European Fit for 55 package are crucial strategies to bridge the gap with the 55% target. A preliminary analysis of the 14 final updated NECPs submitted at the time of drafting this report by the European Commission points to a reduction of this identified gap to the EU's 2030 target of 55%.

Box 1.1

What do we talk about when we talk about the European Climate Law's GHG emissions?

The European Climate Law sets ambitious targets for GHG emissions: a net 55% reduction by 2030 and climate neutrality by 2050. These targets apply to all GHG emissions covered by EU legislation in the 27 EU Member States. Specifically, these emissions include:

- GHGs emitted within the EU from activities such as energy production, industrial processes, waste management and agriculture.
- GHG emissions and GHG removals related to LULUCF, including from forestry, wetland management and other land uses.
- GHG emissions from international aviation and international navigation as covered by the EU ETS. These include all emissions from intra-EU aviation and flights to the UK, Norway and Iceland. For navigation, it includes all intra-EU GHG emissions and 50% of the emissions from journeys between EU and non-EU ports.

This report uses this comprehensive scope for the first time to track progress on the EU climate target, which aligns with the European Climate Law adopted in 2021. This approach ensures consistent progress towards the targets by correctly including international transport emissions. For GHG emissions related to international aviation and maritime activities, the inventory and projections totals (based on bunker fuels) are converted using the JRC-IDEES (JRC 2024a, 2024b) methodology to the relevant GHG emissions covered by the EU ETS.

([2]) In this report, the projected GHG emissions are based on the submissions reported by the Member States, according to Article 18 of the Governance Regulation. Since the publication of this report coincides with the update schedule of the NECPs — with a draft version submitted in June 2023 and final versions expected by June 2024 — not all Member States have included the most up-to-date projections. This is illustrated by the European Commission (EC, 2023), based on the Member States' trajectories in the draft updated NECPs. These projected an overall emissions reduction of 51%, which goes beyond the reduction based on the reported submissions (EC, 2023c). Accordingly, the NECP updates are also expected to increase ambition levels for projected emissions reductions under the LULUCF, ETS and ESR policy frameworks, both at the EU level and for individual Member States.

Deployment of renewable energy

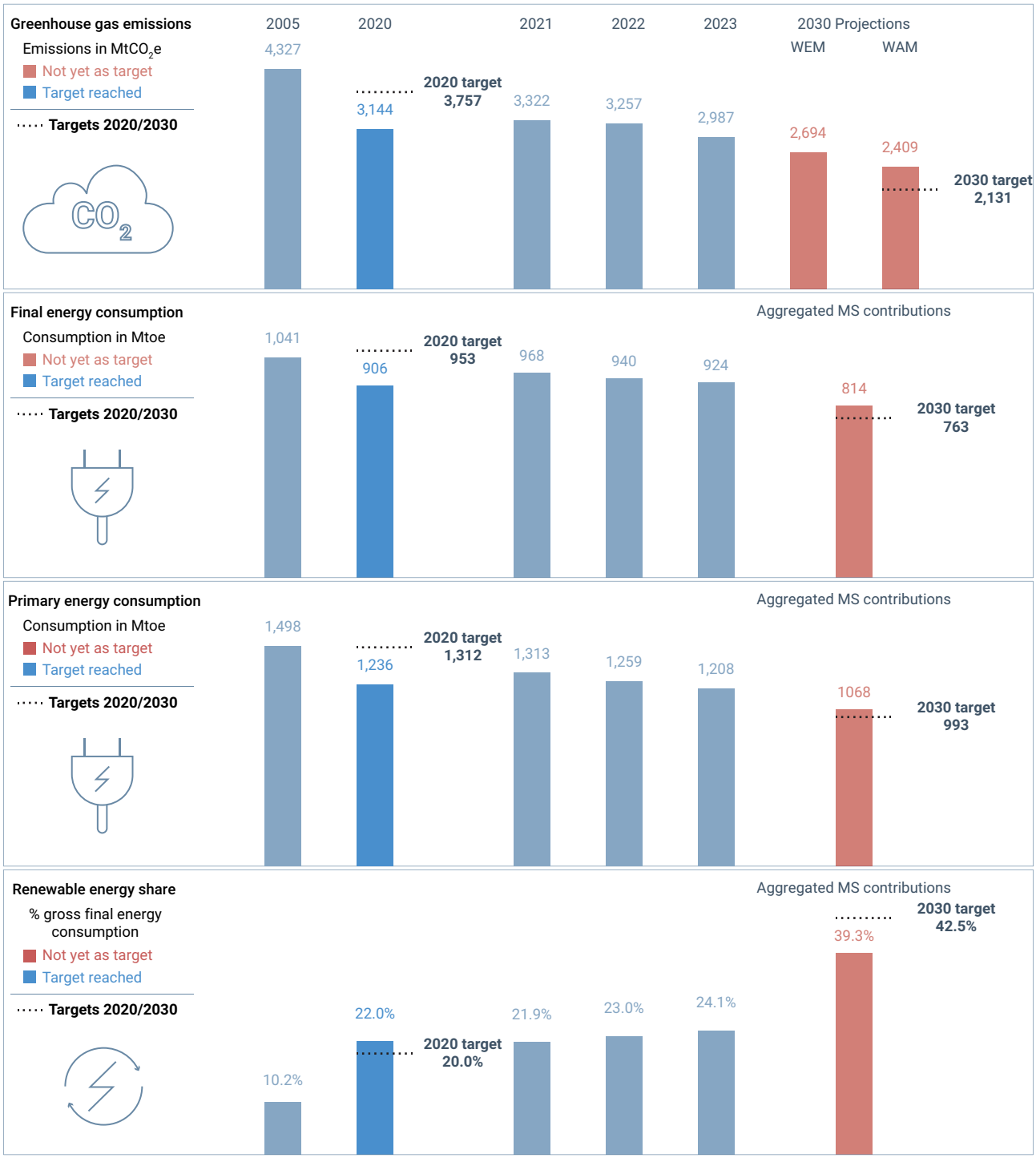
In 2023, renewable energy constituted an estimated 24.1% share of the EU's total energy mix, marking an increase of 1 percentage point from 2022. This growth was primarily driven by a significant expansion of renewable electricity production and further amplified by a reduction in non-renewable energy consumption. In absolute terms, the consumption of renewable energy rose from 227Mtoe in 2022 to an estimated 233Mtoe in 2023, representing an increase of 3%. This anticipated growth in 2023 continued the positive trend observed in 2022, following a decline in 2021 when energy consumption outpaced renewable energy production.

Despite this progress, considerable efforts are required to meet the 2030 target of an EU renewable energy share of 42.5%. The gap between the 23% achieved in 2022 and the 2030 target necessitates an annual increase of 2.4 percentage points, three times more than the average annual growth observed between 2005 and 2022. Strong growth in specific technologies, particularly solar, indicate that this target is achievable. However, active national policies and ambitious national objectives are crucial to sustaining the development of renewable energy. The national contributions outlined in the draft update for the NECPs submitted in June 2023 resulted in an aggregated EU ambition level of between 38.6% and 39.3% in 2030 at the EU level, which falls three percentage points short of the 2030 target (EC, 2023c). Therefore, the update of the NECPs must align with the increased level of ambition needed to achieve the 2030 goals.

Improvement in energy efficiency

The EU's commitment to energy efficiency has led to a significant reduction in energy consumption since 2005, with primary energy use decreasing by 16% and final energy use by 10% as of 2022. Estimates for 2023 suggest a further reduction, with primary energy consumption expected to be 19% lower and final energy consumption 11% lower compared to 2005 levels. However, to meet the 2030 targets, the average annual reduction in primary energy consumption must more than double between now and 2030 compared to the average rates seen since 2005, while the reduction in final energy needs to be more than three times faster.

Figure 1.2 Progress towards achieving 2030 targets in the EU-27



Notes: GHG emissions include LULUCF and international transport emissions, which are aligned with the scope of the European Climate Law. The sum of the 2030 contributions for renewable energy, and primary and final energy consumption are from the Commission's impact assessment of the draft updated NECPs. Aggregated contributions for the share of renewable energy in gross final energy consumption have been given as a range from 38.6% to 39.3% by the Commission (2023a): the higher value is shown here. The 2030 GHG target is derived from the European Climate Law and applies the net 55% reduction to the calculated 1990 baseline figures. According to the European Climate Law, the contribution of LULUCF to the target is limited to a removal of 225Mt, if the removals surpass this level in 2030 this results in a slightly higher reduction than the 55% target.

$MtCO_2e$, million tonnes of CO_2 equivalent.

Mtoe, million tonnes of oil equivalent.

Sources: EEA, 2023, forthcoming a, forthcoming b, forthcoming c, forthcoming e; EU, 2023e; Council of the European Union, 2023; Eurostat, 2023b, 2023c; EC, 2023a.

1.3 EU-wide developments in emissions and energy

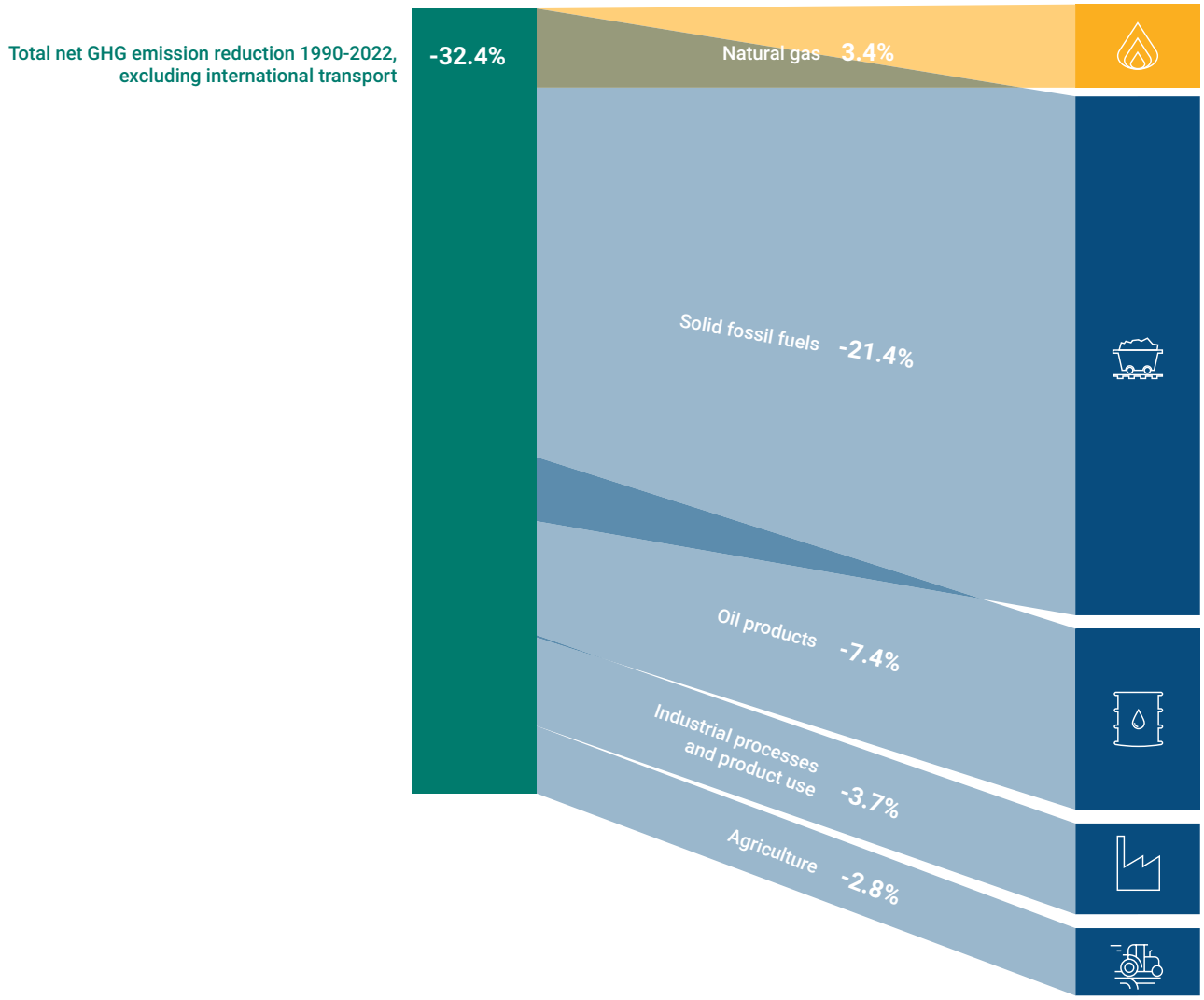
1.3.1 What were the main drivers for the reductions in greenhouse gas emissions since 1990?

The significant emissions reductions estimated for 2023 continue a long-term European trend of decreasing GHG emissions over the past decades, with an average reduction of 1% per year from 1990 to 2022. The pace of this reduction has accelerated over time, with the average annual reduction more than doubling between the periods 1990-2005 and 2005-2022.

The majority of these GHG emissions reductions can be attributed to a decrease in the use of energy-related fossil fuels in the EU. The sharp reduction in GHG emissions associated with solid fossil fuels, which dropped by 60%, accounted for more than half of the total GHG emissions reductions in the EU since 1990. Additionally, GHG emissions from the oil sector have significantly declined during this period. While the increased use of natural gas between 1990 and 2022 has partially offset some of these emissions reductions, overall emissions related to fossil fuel energy have consistently decreased, as illustrated in Figure 1.3. This trend has been driven by substantial improvements in energy efficiency over the years, resulting in lower absolute energy consumption and an increasing share of renewable energy in the EU's energy mix.

GHG emissions not related to energy have also decreased significantly in the EU. For example, emissions from N_2O and CH^4 have dropped due to lower levels of mining activities, a reduced agricultural livestock population and decreased emissions from managed waste disposal and the production of adipic and nitric acid (EEA, 2023a). The EU's LULUCF sector contributed significantly to GHG removals, mainly through CO_2 sequestration by forests. However, although net removal capacity increased until 2010, the annual volume of removals has declined since then.

Figure 1.3 **Contributions of fuels and other sectors to overall EU GHG emissions reductions 1990-2022 (excluding international transport)**



Notes: The percentages shown represent the reduction in the total greenhouse gas emissions (excluding international transport) relative to 1990 levels linked to a specific driver. For example, the reduction in greenhouse gases between 1990 and 2022 related to solid fossil fuels led to a decrease of 21% in total GHG emissions. The emissions reductions linked to fossil fuels encompass all energy-related emissions, including energy use in energy supply, transport, industry and buildings sectors.

Sources: Own calculations, based on EU, 2023e.

Box 1.2

EU GHG emissions in worldwide perspective

Climate change is a global challenge of the highest order, necessitating concerted efforts to reduce greenhouse gas emissions across the world. Although emissions in Europe have fallen substantially since 1990, this is not the case when viewed from a global perspective. According to estimates by EDGAR (Crippa et al., 2024) global GHG emissions (excluding LULUCF emissions and removals) have increased by 62% from 1990 to 2023. At the sector level, worldwide GHG emissions in the energy sector and industrial process emissions have almost doubled since 1990, while transport (+78%) has also seen a significant increase. As a result, the EU's contribution to annual global GHG emissions has decreased. In 1990, Europe accounted for 15% of global emissions. By 2023 this figure was just over 6%. When evaluating per capita emissions, the EU is still above the global average, with emissions of 7.26 tonnes of CO_2 equivalent per capita (tCO_2e/cap), while GHG emissions in relation to GDP in the EU are significantly lower than the worldwide average.

Table 1.1 EU GHG emissions in a worldwide perspective, 2023

	Share in total GHG emissions	Per capita GHG emissions	GHG emissions per GDP
EU	6.08%	7.26tCO_2e/cap	0.13tCO_2e/1000$
Average worldwide		6.59tCO_2e/cap	0.32tCO_2e/1000$

Source: Crippa et al., 2024.

1.3.2 What are the main EU policy tools that are helping reduce greenhouse gas emissions to the 2030 target and how do they compare?

The EU has implemented a broad range of policy measures to ensure that climate objectives are achieved. With a focus on the 2030 climate target, the recent Fit for 55 package has strengthened the existing framework and ensures that GHG emissions are covered by one of the following key policy instruments:

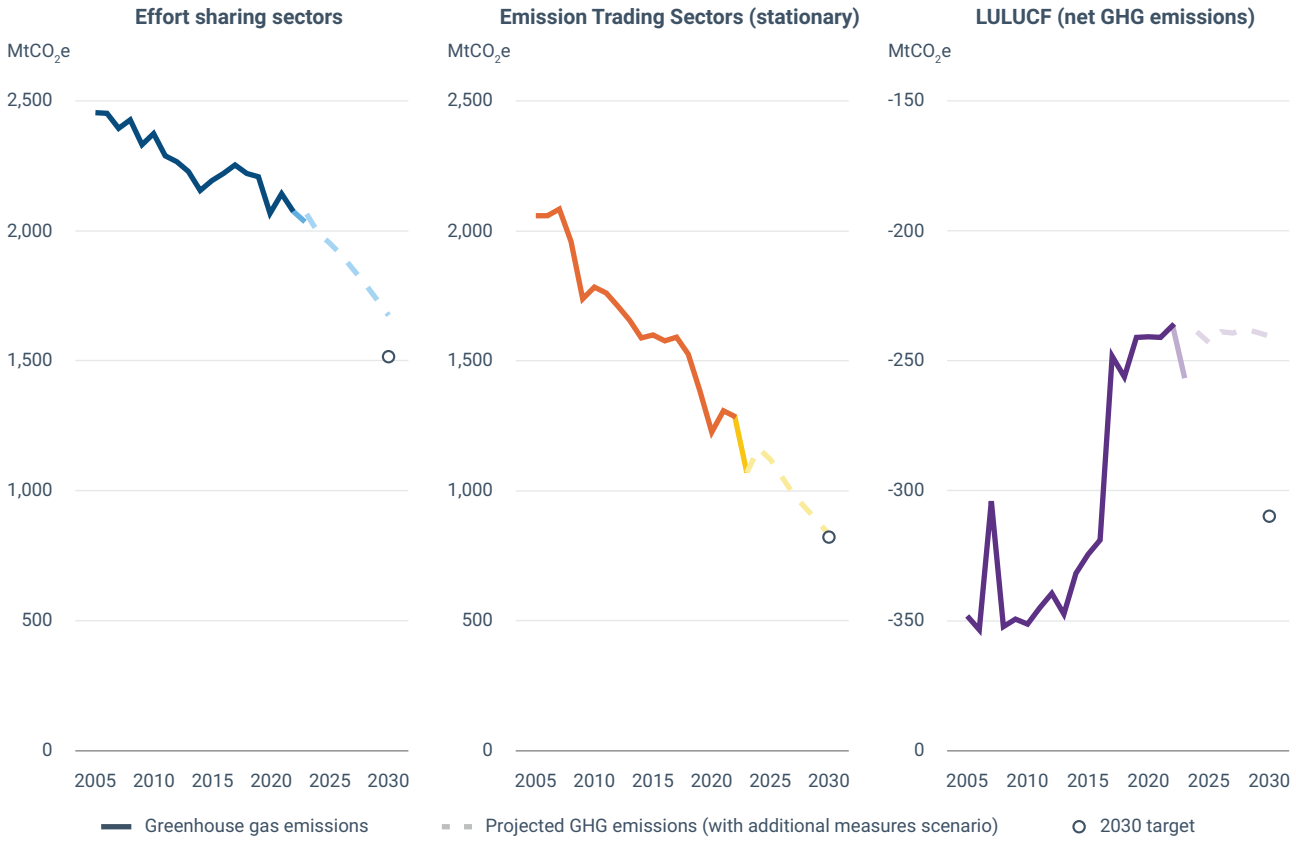
- The EU ETS (EU, 2023b) covers GHG emissions from stationary installations in the power sector and large industrial plants, which together accounted for 37% of total EU GHG emissions in 2022. Since 2012, the ETS has also included CO_2 emissions from aviation, while maritime GHG emissions will be included from 2024 onwards. From 2027, a new and separate ETS will be established covering the CO_2 emissions

from fuel combustion by buildings, road transport and other sectors. The EU ETS is based on a cap-and-trade system. The cap sets the total amount of GHGs that can be emitted by the operators covered by the system. Within the cap, operators buy or receive emissions allowances, which they can trade with one another as needed. With the revision of the ETS Directive in 2023 (EU, 2023c), the cap set by the EU ETS has been tightened, leading to an emissions reduction target of 62% in 2030 compared to 2005 levels. Since 2005, GHG emissions within the ETS sectors (stationary installations) have significantly decreased, with emissions in 2023 being 48% lower than in 2005. Particularly in 2023, the emissions reductions were substantial, with a decrease of nearly 17% for stationary installations compared to 2022. The continued reductions in recent years put the 2030 target within reach, although the Member States' projected GHG emissions for the ETS sector are still more than 10% higher than the target.

- National GHG reduction targets are governed by the ESR (EU, 2023g) and cover the transport, buildings, agriculture and waste sectors as well as emissions from energy and industry installations outside of the current EU ETS system.
  These ESR emissions account for more than 60% of the EU's total GHG emissions. In addition to establishing national targets for the Member States to reduce GHG emissions by 2030, the ESR also defines annual emission limits for 2021 to 2030. With the latest revision of the ESR, collective efforts result in a targeted 2030 emissions reduction of 40% compared to 2005. In 2022, ESR emissions were 18% below the 2005 baseline level, which remain below the trajectory towards the 2030 target set by the legislation. Estimates for 2023 indicate a modest additional decline, bringing ESR emissions
  to 19% below 2005 levels. These reductions again stay under the trajectory set by the ESR towards 2030. To meet the joint ESR target for 2030, Member States will need to implement additional measures to significantly reduce emissions.

- GHG emissions and carbon removals related to land use and land use change are covered by the regulation on greenhouse gas emissions and removals from LULUCF (EU, 2023f). Together these activities act as a net GHG sink in the EU. They remove an equivalent of 7% (236Mt CO_2e) of the EU's annual GHG emissions in 2022. This CO_2 sink has been decreasing over the past decade in the EU, mainly as a result of increased harvesting combined with a stabilisation of forest growth. Preliminary estimates for 2023 suggest a slight increase in carbon removals from LULUCF activities, although this trend requires confirmation through final data, given the differences between estimated and final data in this sector over the years. Member States' projections indicate a stabilisation of the removal capacity toward 2030, leaving a gap to the LULUCF target.

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



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

Sources: EEA, 2024a, 2024b, forthcoming f, forthcoming g.

1.3.3 What trajectory can we follow to reach climate neutrality?

The 2030 climate target aligns with the broader EU goal of achieving climate neutrality by 2050 at the latest. To refine the path towards this goal, the Commission has assessed various options for establishing an additional interim reduction target for 2040 (EC, 2024c). Based on a comprehensive impact assessment (EC, 2024b), a Commission communication (EC, 2024c) recommended a 90% reduction in the EU's net greenhouse gas emissions by 2040 relative to 1990 levels. This recommendation reflects the minimum target level for 2040 recommended by the European Scientific Advisory Board on Climate Change (European Scientific Advisory Board on Climate Change, 2023). This approach provides the greatest certainty for reaching climate neutrality by 2050, while also enhancing predictability and minimising the total greenhouse gas budget emitted within the EU.

Achieving a 90% emissions reduction will require maintaining the rapid pace of emissions reductions necessary to meet the 2030 target through to 2040 and allow the EU to achieve climate neutrality by 2050 at the latest. According to the impact assessment, reaching these emissions reductions will build on the continuation and scaling up of efforts such as the electrification of energy demand, the deployment of renewable energy sources and improvements in energy efficiency. Additionally, lifestyle changes can contribute to achieving the necessary emissions reductions at a lower cost and most likely with less environmental disturbances. However, these factors may take a considerable time to materialise. The Commission's communication and analysis (EC, 2024c) emphasise the critical role of carbon management on the path to climate neutrality along with large-scale and rapid investments in zero and low-carbon technologies. Consequently, there will be a difference between the total emissions generated in 2040 and the net emissions that reach the atmosphere as illustrated by Figure 1.5. The following carbon management methods are considered in the 2040 emissions modelling (EC, 2024b):

- Fossil carbon capture and storage (CCS): a portion of the greenhouse gas emissions produced by industry and electricity generation from fossil fuels or processes will be captured at the source and stored, resulting in a total reduction of 38-169 million tonnes of CO_2 (S1-S3([3])) from the residual emissions in this sector. Such carbon capture and storage technology is counted as a recovery of CO_2 from the atmosphere, not a removal. The industrial carbon management communication (EC, 2024d) outlines the necessary conditions to achieve these volumes.

- Carbon capture and storage of biogenic CO_2 emissions (BioCCS) and direct air carbon capture and storage (DACCS): these technologies involve capturing carbon dioxide from bioenergy production and directly from the air and storing it underground or in other stable forms. Carbon capture and storage with these technologies is counted as a removal of CO_2 from the atmosphere. From both technologies, 4-75 million tonnes of CO_2 equivalent will be removed from the atmosphere and stored underground in S1-S3.

- LULUCF: this sector is expected to make a significant contribution, with a net removal of 218-317 million tonnes of CO_2 equivalent (S1-S3) projected by 2040.

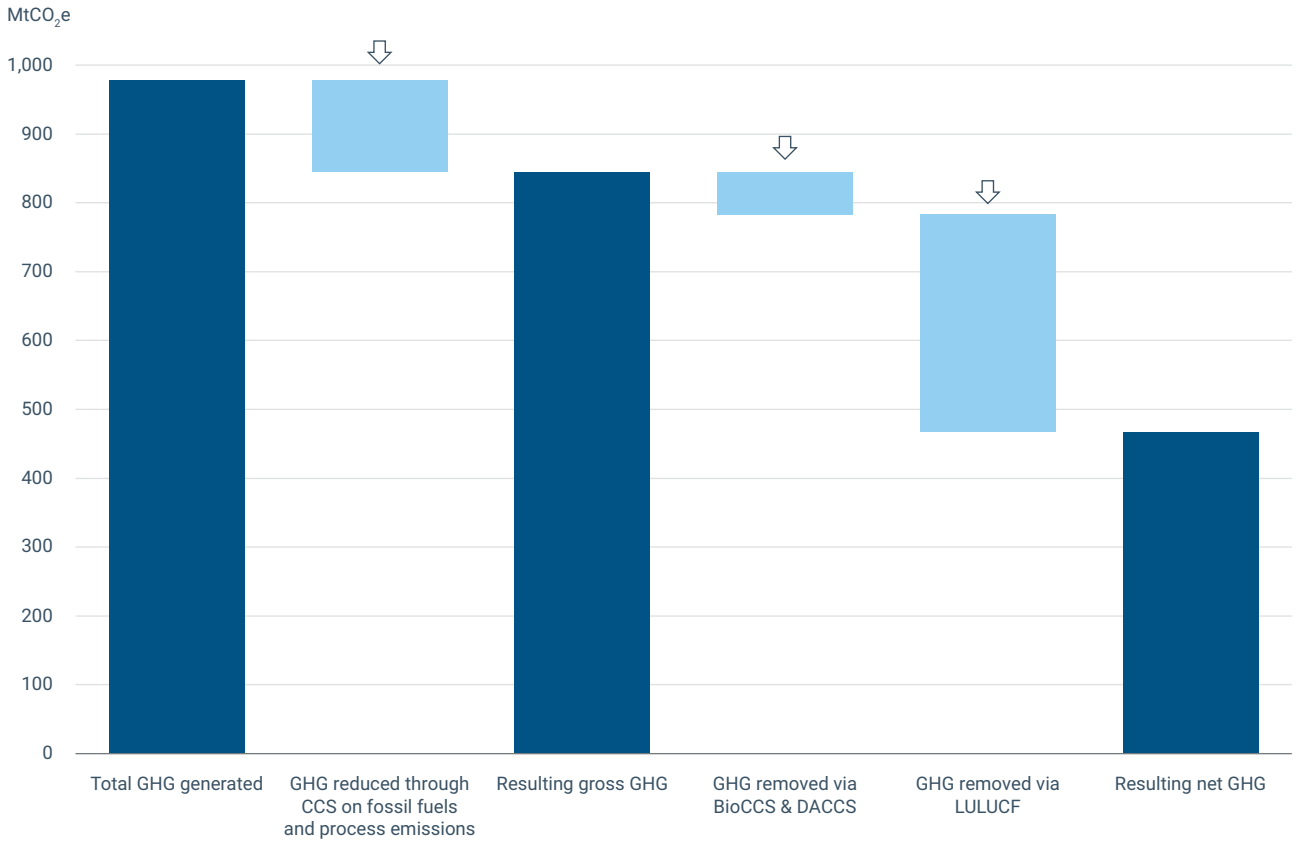
- Carbon capture and usage (CCU): this is a carbon management technology that includes the production of e-fuels and synthetic materials with carbon captured at source streams. The storage times of e-fuels are usually not considered, while for

([3]) In its impact assessment the Commission considered three target options for 2040. S1 results in an emission reduction in 2040 of 80% compared to 1990, S2 reaches a reduction of at least 85%, while S3 results in a reduction of at least 90%.

certain materials longer storage times could be taken into account. Until 2040 only the production of e-fuels is considered by the impact assessment (EC, 2024b), with 43-101 million tonnes of CO_2 equivalent (S1-S3).

The next European Commission will be responsible for proposing legislation to incorporate the 2040 target into the European Climate Law and for establishing an appropriate post-2030 policy framework to achieve this target in a fair and cost-effective manner. On the international stage, all parties to the Paris Agreement, including the EU, are also required to submit a new nationally determined contribution (NDC) by 2025.

Figure 1.5 Sectoral results of the impact assessment for a 90% reduction scenario 2040 (S 2.5)



Notes: In this figure the data relate to a constructed 'Scenario 2.5', being the average scenario of S2 and S3 from the impact assessment (EC, 2024b). This Scenario 2.5 resultsin a decrease in net emissions of 90% by 2040. Gross and net emissions follow the information given in the impact assessment, while the dimension of GHG generation is an addition to better explain the effects of carbon management. As in 2040, CCU is only considered for e-fuels. This technology has no effect on the overall emissions situation, as it can be assumed that captured amounts of CO_2 are emitted in the same year.

Sources: Öko-Institut, 2024a, based on EC, 2024a, 2024b.

1.4 EU-wide evolutions in renewable energy sources

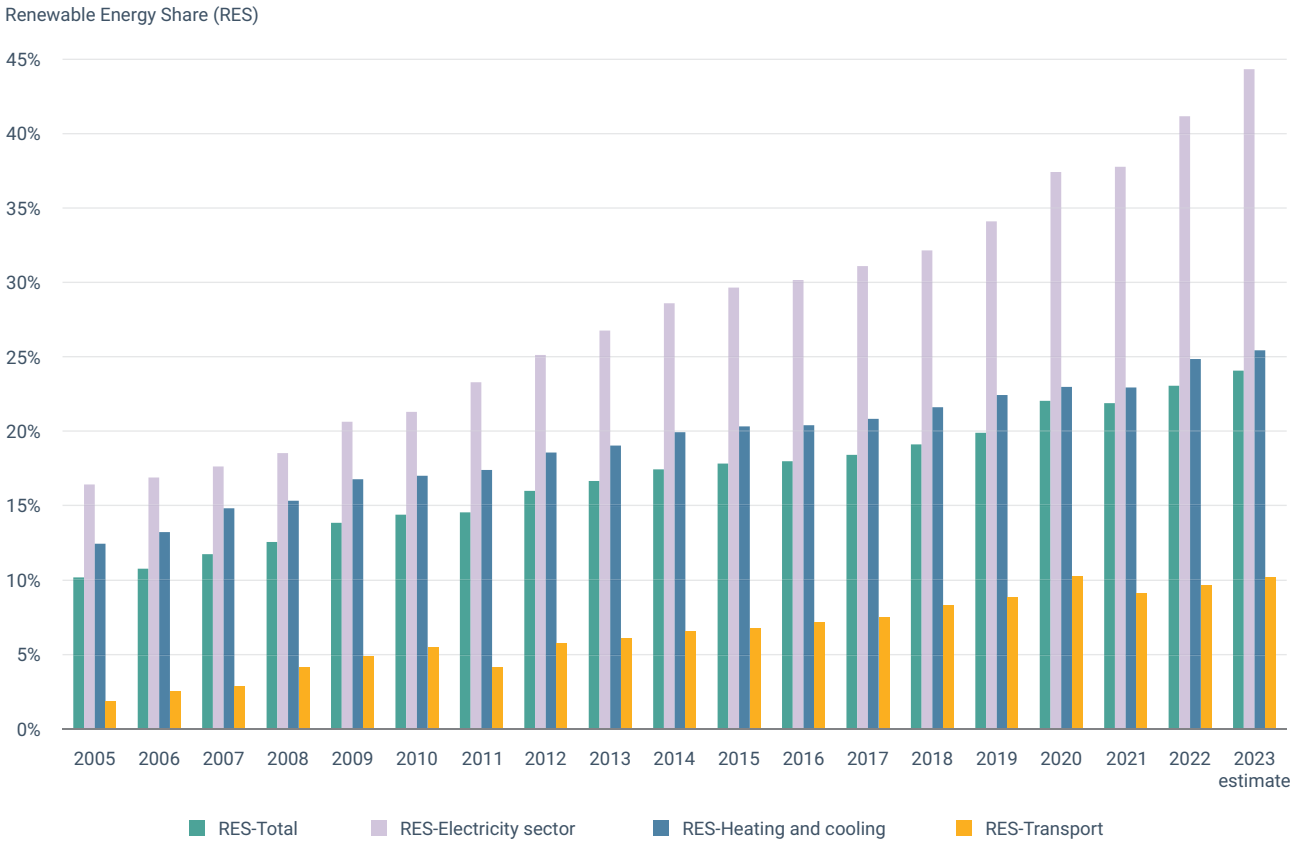
The current target share of renewable sources in the EU's gross final energy consumption in 2030 is to reach at least 42.5% and to aim at reaching 45% (EU, 2023d). Each Member State contributes to this target via its updated NECP,

for which the final versions were due by the end of June 2024. The EU-wide total renewable energy share on gross final energy consumption (RES-Total) grew from 10.2% in 2005 to 23.0% in 2022 (Figure 1.6). This is an average annual linear growth of 0.8 percentage points. Preliminary estimates indicate the RES-Total share for 2023 was 24.1%.

Electricity is not the biggest sector when it comes to total energy consumption, but it is the sector in which renewable energy has progressed most. The electricity sector (RES-E) accounted both for the largest share and the largest average annual growth from 2005 to 2022, with the RES-E share growing from 16.4% in 2005 to 41.2% in 2022. Preliminary estimates indicate that RES-E stood at 44.3% in 2023.

The EU's renewable energy share in heating and cooling (RES-HC) grew from 12.4% in 2005 to 24.9% in 2022, averaging a 0.7 percentage points increase per year. RES-HC shares are preliminarily estimated to have been 25.4% in 2023. With more modest growth, renewable energy shares in transport (RES-T) grew from 1.8% in 2005 to 9.6% in 2022, averaging an increase of 0.5 percentage points per year. For 2023, preliminary estimates suggest a RES-T share at 10.1%.

Figure 1.6 Renewable energy shares in gross final energy consumption, 2005-2023

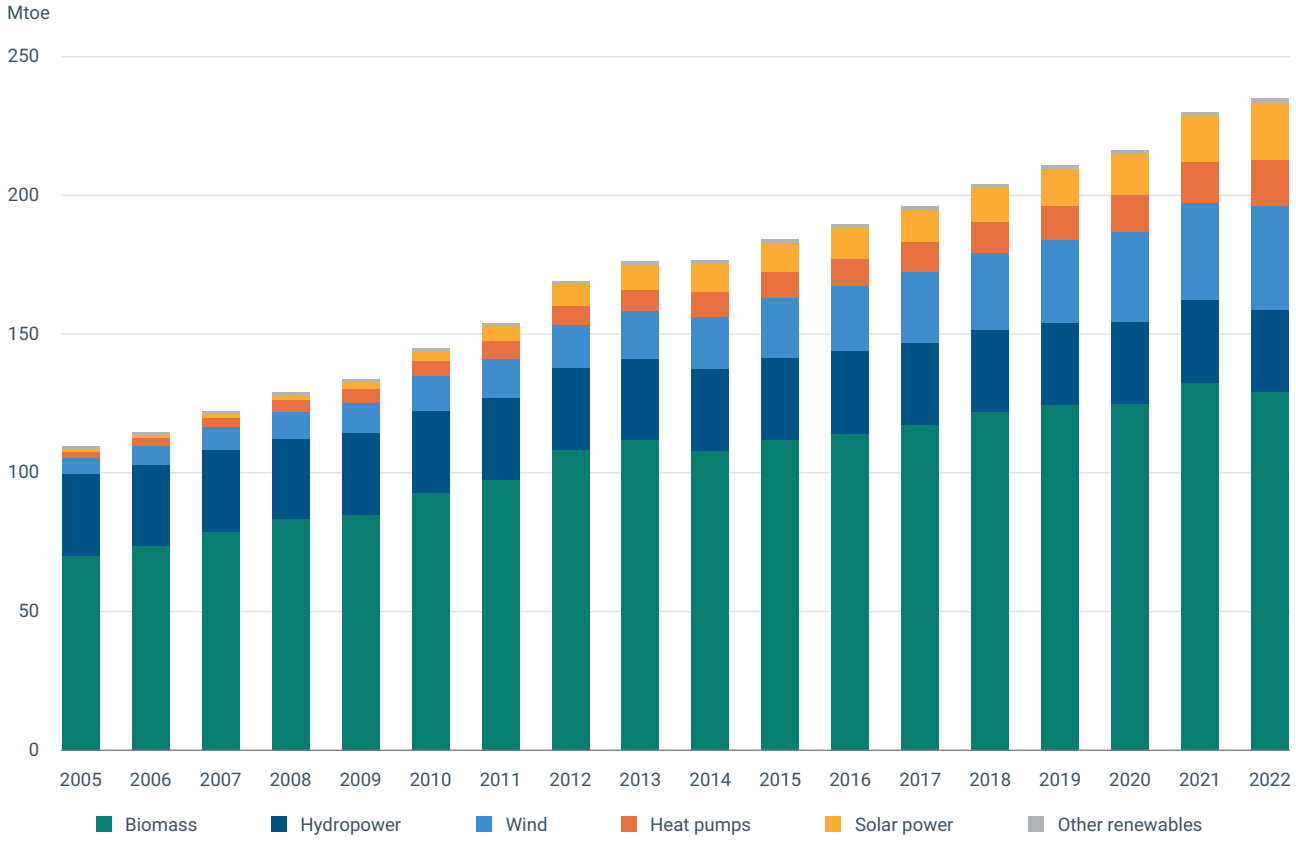


Notes: This figure shows the share of renewable energy used in the EU-27 across the electricity, heating and cooling, transportation and overall energy use sectors. These percentages are presented as a share of the gross final energy consumption across the different categories, with the 2023 values referring to estimates.

Sources: Eurostat, 2023d; EEA, forthcoming c.

The 2022 RES-total share of 23% lies 19.5 percentage points below the 2030 target (excluding the additional top-up). This means RES-total share will need to increase by 2.4 percentage points per year until 2030 to be in line with the 2030 target, three times more than the average annual growth observed between 2005 and 2022.

Figure 1.7 Renewable gross final energy consumption in the EU-27 by technology



Notes: In the graph, the 'biomass' category bundles solid biomass, biogas, bioliquids, biodiesel, biofuels, biogasoline and renewable municipal waste. 'Solar' refers to concentrated solar power, solar photovoltaic and solar thermal. 'Hydropower' covers normalised hydropower excluding pumping. 'Wind' refers to normalised onshore and offshore wind. 'Heat pumps' refers to renewable energy from heat pumps. 'Other renewables' includes tidal, wave and ocean energy and geothermal electricity. Categories were aggregated from the SHARES Details data files.

Sources: EEA, 2023, based on Eurostat, 2024d.

In absolute terms, total renewable energy use grew by 115% since 2005, as illustrated by Figure 1.7. The largest growth during that period was the 24-fold growth of solar power, followed by heat pumps (which grew 12-fold) and wind power 6-fold. None of these sources had made up more than 5% of the EU RES share in 2005, while biomass stood at 64% then. Biomass now stands at 55%, while the share of wind grew from 5% in 2005 to 16% in 2022. It is the second largest source of renewable energy as of today. Solar power and heat pumps made up 9% and 7% of renewable energy sources in 2022.

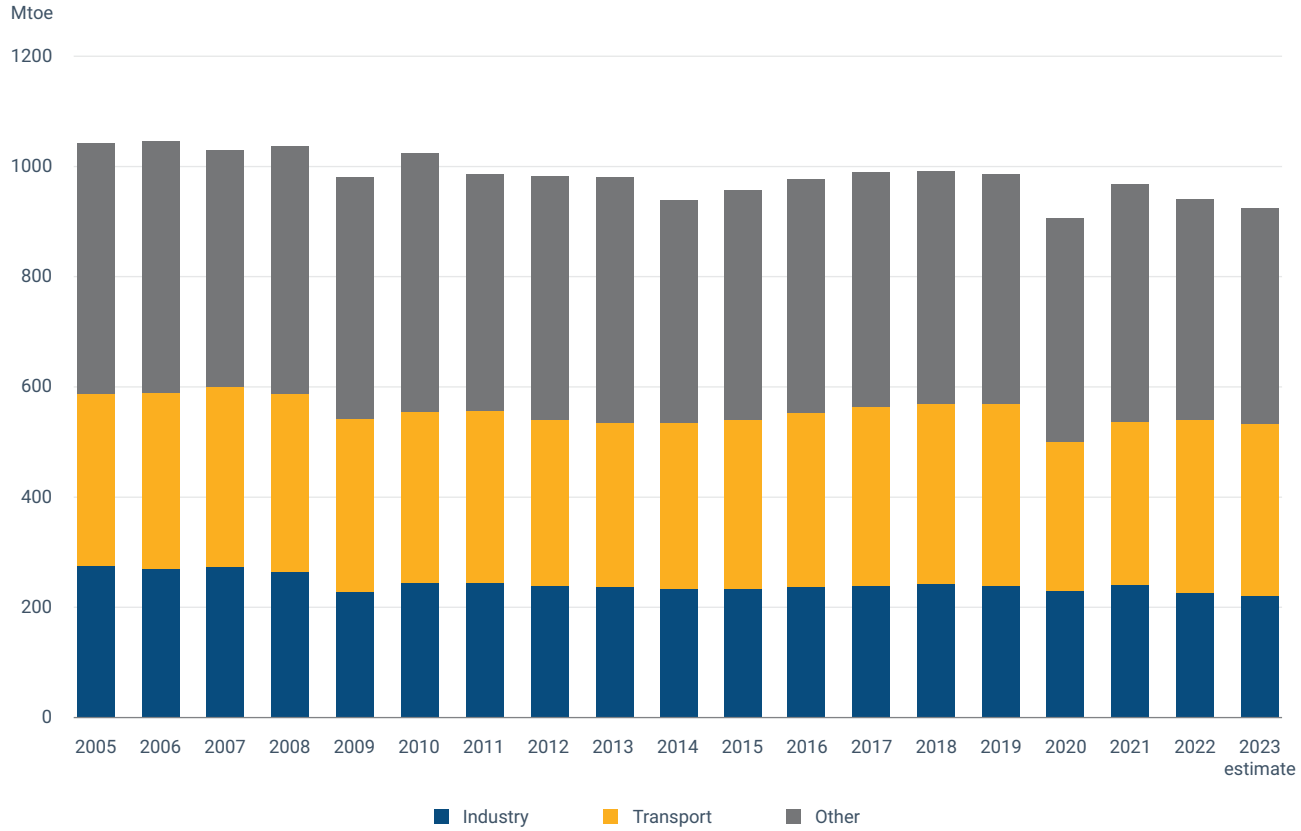
1.5 EU-wide evolutions in energy efficiency

In July 2023, the EU adopted the revised Energy Efficiency Directive (2023/955), which establishes a framework for achieving an 11.7% reduction in EU energy consumption by 2030 compared to the 2020 reference scenario projections. The directive introduces a binding final energy consumption target of no more than 763Mtoe by 2030 and sets an indicative target for primary energy consumption at no more than 992.5Mtoe. It also implements various policy measures to promote energy savings across different economic sectors, with a particular focus on the public sector (EU, 2023c). Member States shall collectively ensure that these EU-wide targets are achieved by including an updated national contribution in their NECPs. These 2030 targets require substantial acceleration in energy efficiency. In 2022, the final and primary energy consumption levels in the EU-27 were 22% above the newly adopted 2030 targets ([4]).

Figure 1.8 illustrates the evolution of final energy consumption since 2005, which indicates that only limited progress has been made in this period. The final energy consumption for 2023 is estimated to be 11% lower than in 2005. At the same time, the distribution between sectors has remained relatively constant over this period, with industry accounting for about 25% of final energy consumption, and transport accounting for just over a third. In recent years, the COVID-19 pandemic and the energy crisis have impacted energy consumption. In 2020, final energy consumption dropped by 8% due to declines in industry and transport. This was followed by a historic 7% rebound in 2021 and a more modest 3% decline in 2022, which was driven by the energy crisis. In 2023, final energy consumption decreased by 2% compared to 2022 according to early estimates. The 2023 estimates indicate that the industry sector showed a decrease of 3% compared to 2022, while the transport sector experienced an estimated stabilisation.

([4]) This takes into account the change in the definition of final energy consumption in the EED recast.

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



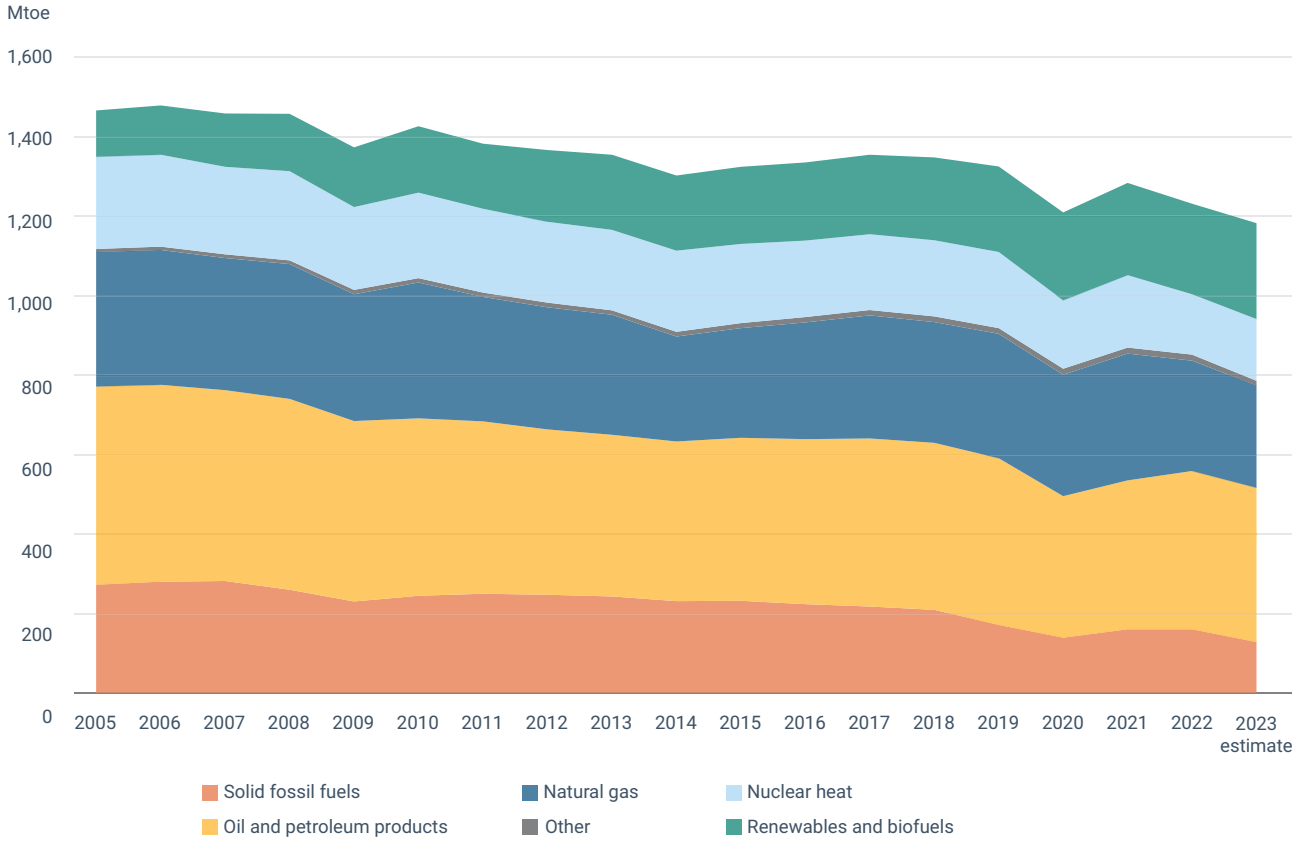
Notes: This figure illustrates the evolution of final energy consumption in the EU-27 by end-sector. Data for 2005-2022 rely on Eurostat (2023a), whereas 2023 data are based on estimates by the EEA for primary and final energy consumption (EEA, forthcoming e). The 'Other' category comprises commercial and public services, households, agriculture and forestry, fishing and other sectors.

Sources: Eurostat, 2024b; EEA, forthcoming b.

To meet the 2030 target, a significant increase in the pace of energy savings is required for both primary and final energy consumption. The average annual reduction in primary energy must more than double that of the period since 2005, while the reduction in final energy needs to be more than three times faster.

Although primary energy consumption follows a similar trend to final energy consumption, its decline has been more pronounced in recent decades due to changes in the fuel mix (16% lower in 2022 compared to 2005), with a further estimated year-on-year reduction of 4% in 2023. More specifically, Figure 1.9 illustrates the growing prominence of renewable energy in the energy mix, making it the third largest energy source in the EU by 2022 after oil and natural gas. Preliminary estimates for 2023 indicate substantial year-on-year reductions in the consumption of solid fossil fuels (-20%), natural gas (-7%) and oil consumption (-3%). Both nuclear heat (+3%) and in particular renewables (+6%) showed an estimated increase in primary energy consumption.

Figure 1.9 Primary energy consumption per source in EU-27, 2005-2023



Notes: This figure illustrates the evolution of primary energy consumption (PEC) in the EU-27 since 2005 categorised by energy source. The PEC 'Other' category is primarily composed of non-renewable waste as an energy source. Data for 2005-2022 rely on Eurostat (2023a), whereas 2023 data are based on estimations regarding primary and final energy consumption by the EEA (forthcoming e).

Sources: Eurostat, 2024b; EEA, forthcoming b.

2 Greenhouse gas emissions and energy trends at the sectoral level

Key messages

- Progress in reducing GHG emissions varies widely across Europe's economic sectors. As of 2022, the energy supply sector had reduced its emissions by almost 50% compared with 2005 levels. The waste, industry and buildings sectors reduced their emissions by more than 30% over the same period, while in the agricultural and domestic transport sectors, emissions fell by only 7% and 5%, respectively. Between 2005 and 2022, the LULUCF sector's capacity to capture and store CO_2 decreased significantly. This trend needs to be reversed to meet the 2030 LULUCF target.

- Estimates for 2023 see these historical trends continue. The energy supply sector recorded an estimated 19% year-on-year reduction in GHG emissions between 2022 and 2023, driven by the roll-out of renewable energy production as well as a limited decrease in electricity production. In the industrial sector, GHG emissions are estimated to have decreased for the second year in a row by 6%, in part due to reduced industrial production in specific energy-intensive sectors. A similar percentage decrease in GHG emissions was seen from the buildings sector. The transport and agricultural sectors experienced more limited decreases of 1% and 2% respectively. 2023 estimates suggest a rise in CO_2 removal by the LULUCF sector — a possible reversal of the prior trend — but more such progress in the coming years will be needed to cement this shift.

- Looking towards 2030, efforts need to intensify across all sectors. Based on existing and planned policies, Member States predict substantial emissions reductions across the board in 2030. However, the 2030 emissions projections fall short of those envisaged in the MIX-55-scenario across all sectors, which are coherent with achieving the overall 55% reduction target.

2.1 Historic evolutions per sector

GHG emissions are intrinsic to many aspects of society: from how our food and energy are produced to how we transport ourselves and where we live. Our environment also plays a role, with GHG emissions being both released and absorbed by our forests and soils. Under the reporting rules of the UNFCCC, GHG emissions are reported by sector, factoring in their direct emissions.

For example, in the buildings sector, emissions from direct combustion installations in commercial and residential buildings are reported, while emissions associated with domestic electricity consumption are reported under the energy sector ([5]). GHG emissions vary by sector over time due to differences in activity levels and reduction opportunities. Moreover, the potential for future reductions also varies between sectors. This chapter shows historical changes in the most important sectors (Table 2.1), a closer look at the latest developments in 2023 and a forward look to 2030.

([5]) In other reports and indicators, for example the EEA indicator on *Greenhouse gas emissions from energy use in buildings in Europe,* indirect GHG emissions linked to, for example, electricity use are taken into account.

Table 2.1 Evolution of GHG emissions by sector, 1990-2022

Sector	Share of total 2022 emissions	Average annual GHG emissions change 1990-2000	2000-2010	2010-2022	Activities, trends and drivers of GHG emission changes: Main activities	Overall trend	Main drivers
Energy supply	27%	-1.2%	-0.5%	-3.1%	Electricity and heat production.	Emissions have continuously decreased since 1990, with a significant 43% reduction by 2022, making up over half of the EU's total emission cuts.	Shift from coal to natural gas and widespread adoption of renewable energy sources.
Domestic transport	23%	1.9%	-0.3%	-0.2%	Domestic transport activities, of which more than 75% are road-based.	Unlike other sectors, the transport sector's GHG emissions are substantially higher in 2022 than in 1990. There has been a limited decrease in emissions since 2007, with more significant reductions in recent years.	Increasing car ownership and passenger and freight kilometres have raised emissions, while recent decreases have been driven by COVID-19 and new, lower-emission cars.
Industry	20%	-1.5%	-1.4%	-1.4%	Industrial GHG emissions from both energy and processes.	Consistent decreased emissions, with a 42% decrease between 1990 and 2022.	While reductions in previous decades can be attributed to the restructuring of the European economy, significant decreases in process-related emissions and improved energy efficiency (EEA, 2020), substantial reduction in 2021 and 2022 are partly linked to a decrease in industrial output.
Buildings	14%	-1.2%	-0.2%	-2.3%	Combustion of fossil fuels for space and water heating in buildings.	Emissions have consistently decreased, achieving a 35% reduction between 1990 and 2022.	Better insulation, use of less carbon-intensive fuels and reduced heat demand due to milder winters counterbalanced by increases in the size and number of houses in the EU.
Agriculture	10%	-1.6%	-0.7%	-0.3%	Non-CO_2 GHG emissions from livestock, fertiliser and manure.	GHG emissions fell by 24% from 1990 to 2022, with significant reductions up to 2005 and relatively little progress since.	Lower GHG intensitis per unit of production due to efficiency gains have been counterbalanced by increased production, hence the stalling in progress since 2005 (EEA, 2022b).
Land use, land-use change and forestry (LULUCF)	-7%	-4.3%	-1.9%	3.6%	GHG-emitting activities (deforestation, wetland drainage, ...) and activities that remove CO_2 from the atmosphere and store it as carbon in biomass and soils.	Overall, LULUCF activities act as a net GHG sink in the EU, removing the equivalent of 7% of the EU's annual GHG emissions in 2022. Removal capacity increased from 1990 to 1995 and stabilised thereafter, but significantly decreased over the last decade to nearly the 1990 level.	Sink of forest land decreased due to a decrease in the net growth of the forests, an increase in harvest and natural disturbances.

Note: The 'energy supply' sector covers GHG 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. and 1.A.5; 'agriculture' covers category 3; and 'LULUCF' covers category 4. In the latter, the displayed emissions trend specifically relates to the net GHG emissions of LULUCF activities. This means that an increase in carbon removals results in a decrease in net emissions and vice versa.

Sources: EEA, 2024a.

2.2 Changes in sectoral emissions in 2023

In the energy supply sector, which has consistently held the largest share of GHG emissions in the EU since 1990, emissions reduced by 19% between 2022 and 2023. This represents the most significant drop in emissions since 1990, reversing modest increases seen in 2021 and 2022 as a result of a temporary surge in fossil fuel usage during the energy crisis. The sector's emission levels are now back on the same steep downward trajectory seen in previous years. The reduction in this sector accounted for more than half of 2023's total estimated emissions reductions, as illustrated in Figure ES.2. This sharp decline can be attributed to several factors. Firstly, hydropower and nuclear energy production rebounded in 2023 after significant dips in 2022 due to exceptional circumstances. In addition, the total amount of energy generated in 2023 was lower than in recent years, linked to lower (estimated) energy consumption. Finally, a significant role has been played by the ongoing expansion of renewable energy sources.

In the industrial sector, GHG emissions are estimated to have decreased by 6% since 2022, with both energy-related emissions (-5%) and industrial process emissions (-7%) dropping. Detailed figures from sectors covered by the ETS system reveal that the most significant emissions reductions occurred in the iron/steel and cement industries. While overall production volumes in the manufacturing sector declined by 1% between 2022 and 2023, the volume indices for energy-intensive sectors such as the manufacture of basic chemicals (-13%), cement, lime and plaster (-8%) and basic iron and steel (-8%) showed more pronounced decreases according to Eurostat's annual data on industry production (Eurostat, 2024c).

In the transport sector, preliminary data for 2023 estimate a 1% reduction in emissions since 2022. This decrease comes despite a 3% reduction in road freight kilometres (Eurostat, 2024e), while the sale of electric vehicles saw an increase from 22% of all new vehicle sales in 2022 to 23% in 2023. Among these, Battery Electric Vehicles (BEVs) accounted for 15% of all new car registrations in 2023, bringing the share of BEVs in the EU's passenger car fleet to 1.7% (EC, 2024e). With this modest reduction in emissions compared to other sectors, transport became the largest source of GHG emissions in the EU in 2023, accounting for nearly a quarter of total emissions.

In the buildings sector, considering direct emissions from fossil fuel combustion in the residential and service sectors ([6]), preliminary figures indicate a 6% decrease in GHG emissions compared to the previous year. This decrease occurred amid a slightly lower number of heating and cooling degree days in 2023 compared with 2022 (Eurostat, 2024a), along with the further deployment of low-carbon technologies such as heat pumps. At the same time, however, the growth of new heat pump installations in Europe was lower in 2023 than in the record year of 2022 (EHPA, 2024).

In 2023, emissions from the agricultural sector decreased by an estimated 2%, with reductions evenly distributed across emissions associated with agricultural soils, enteric fermentation and manure management.

Preliminary figures for LULUCF indicate that, in 2023, GHG removals by the sector increased significantly more than emissions, leading to a rise in net removals from 236Mt CO_2e in 2022 to an estimated 257Mt CO_2e in 2023. While this appears to be an

([6]) In addition, this category includes emissions from fuel combustion in fisheries and agriculture.

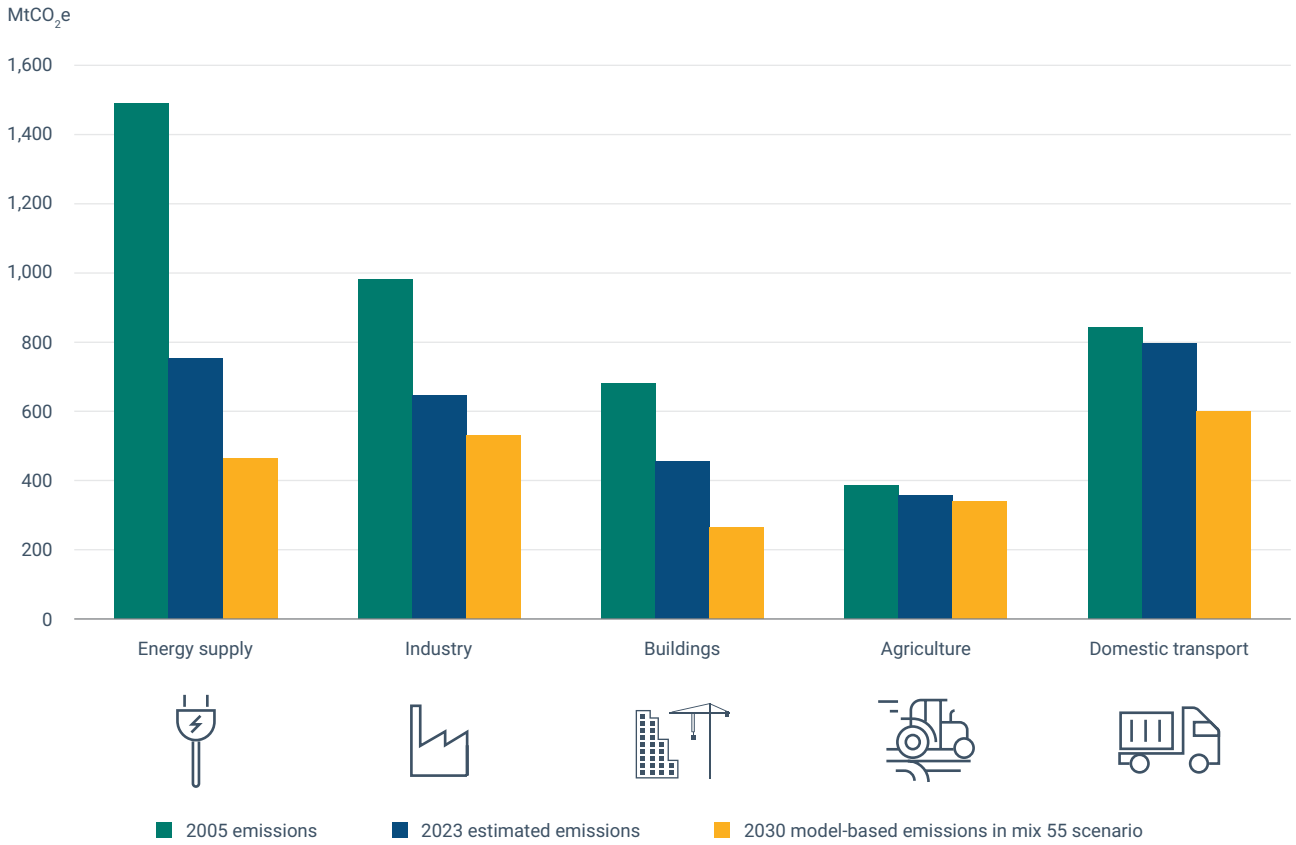
improvement over the emissions increases recorded over the last decade, this trend must be confirmed in the final GHG inventory and sustained over the coming years.

2.3 Sectoral emissions pathways towards 2030

To achieve the European climate target of a 55% reduction by 2030, all sectors will need to implement substantial emission reductions that are aligned with their cost-effective emission reduction potential. Aside from the overall targets set for the ETS sectors and the aggregate targets for the ESR and LULUCF sectors, there are no specific binding European targets at the sectoral level. However, modelling conducted by the European Commission as part of the Fit for 55 package provides a clear indication of the necessary efforts across various sectors by 2030. This analysis indicates that, compared to 2005, emissions reduction potential is particularly high in the energy and building sectors and lower for sectors such as agriculture and transport.

When comparing estimated 2023 emissions with those modelled for 2030, it is clear that the energy supply and industry sectors — thanks in part to significant reductions in 2023 — are on course to reach the modelled emission levels for 2030. On the other hand, the transport and building sectors in particular need to accelerate their emissions reductions.

Figure 2.1 Sectorial progress towards 2030



Notes: The model-based emissions in the MIX 55 scenario refer to a core policy scenario underpinning the 2030 Climate Target Plan (EC, 2021b).

Sources: EEA, 2024a; EEA, forthcoming e.

To bridge the gap between current emissions and the modelled contributions for 2030, there is an urgent need for a rapid, robust and effective implementation of the Fit for 55 Package across all sectors, as highlighted by the European Scientific Advisory Board on Climate Change (ESABCC,2024). EU-wide policy instruments — such as the introduction of the new emission trading system for energy-related emissions in transport, buildings and other sectors from 2027 onwards — will provide additional incentives for emissions reductions. In addition, a significant responsibility lies with Member States, which must update their NECPs to align national ambitions and measures with EU-level targets, as also emphasized in the recent State of the Energy Union Report (EC, 2024). In the buildings sector, for example, this means implementing large-scale renovation plans to realise the cost-effective emissions reduction potential of this sector, as well as accelerating the deployment rate of technologies such as heat pumps.

Beyond 2030, sustained EU-level action remains vital. Achieving the recommended 90% reduction in emissions by 2040 and progressing towards climate neutrality requires a robust post-2030 policy framework to ensure fair and cost-effective delivery of the 2040 target. The ESABCC (2024) stresses among others the importance of strengthening EU climate governance and compliance mechanisms, aligning key sectoral policies such as the common agricultural policy with EU climate objectives, as well as increasing public and private investments in climate mitigation.

3 Greenhouse gas emissions and energy trends in European countries

Key messages

- Overall, GHG emissions reductions among EU Member States vary significantly. While countries such as Lithuania, Romania and Sweden have reduced their net GHG emissions by more than 70% since 1990, others like Cyprus and Ireland have seen an increase in net emissions.
- Focusing on the binding national climate targets under the ESR, most countries' emissions remain below the trajectory, although an increasing number of Member States are falling behind. In 2022, emissions in the effort sharing sectors were lower than the respective AEAs for all except eight Member States (Croatia, Cyprus, Hungary, Ireland, Italy, Lithuania, Malta and Romania). Preliminary estimates indicate that this number will rise to ten in 2023.
- Looking ahead to 2030, all Member States except Greece and Portugal project that they will have higher ESR emissions than their national reduction targets. This number is reduced to 22 if reported additional policies and measures are taken into account. The ongoing update of the NECP is expected to contribute to further emissions reductions among Member States.
- Member States also have national targets under the LULUCF Regulation. In 2022, nine Member States removed more GHG emissions than their 2030 target. However, EU-wide removals are projected to increase only slightly going forward, while some of the countries with the highest removals (Poland, Romania and Spain) project a decrease in this capacity towards 2030.
- Regarding renewable energy, 21 of the 27 EU Member States saw an increase in their renewable energy shares between 2022 and 2023. Austria, Lithuania and Spain topped the list, having increased their shares by two percentage points or more in 2023. In contrast, those of Croatia, Luxembourg and Sweden decreased by roughly two percentage points over the same period.
- On the energy efficiency front, there remains a considerable gap to energy consumption targets. In 2022, several Member States were lagging behind a linear trajectory based on the national contributions set for final and primary energy consumption in 2019. Since the new EU targets for energy efficiency require much more ambitious contributions from Member States, significant efforts must be made to catch up.

3.1 Diverse GHG emissions among Member States

The EU GHG emission inventory is the sum of the Member States' GHG inventories and thus reflects Europe's diversity. Smaller Member States such as Malta and Cyprus contribute less than 0.1% of total EU GHG emissions, while Germany (24%), Italy (13%) and France (12%) together account for almost half of the net GHGs emitted in the EU-27 in 2023. The same diversity is evident when examining the changes per Member State since 1990, with reductions ranging from a substantial drop of more than 70% of net GHG emissions in Lithuania, Romania and Sweden to an increase in net GHG emissions in Cyprus and Ireland, as illustrated in Figure 3.1.

These changes have various drivers. A key factor is the starting point. In some countries, the 1990 baseline was dominated by coal-based emissions, providing an opportunity to reduce GHG emissions through fuel switching. In other countries, factors such as economic and population growth led to an increase in GHG emissions and of course the policy mixes that countries pursue further influence their emissions profiles. Furthermore, net GHG emissions include both the GHGs emitted in the territory of the Member State and the net emissions removed from the atmosphere through land-based carbon removals. For the three countries with the largest reduction in net GHG emissions — Romania, Sweden and Lithuania — the LULUCF removals have a share of at least 30% of the total GHG emitted. Notably, Sweden achieved negative emissions as early as 2013 and 2014. Since then, net emissions have slightly increased, mainly due to a reduction in GHG removals through the LULUCF sink.

Figure 3.1 Evolution of net GHG emissions per Member State, 1990-2023

Notes: The x-axis reflects the Member States' net GHG emissions. These include removals and emissions from LULUCF activities, while on the y-axis these are excluded. Emissions from international aviation and international navigation are not included. Note that the climate targets for Member States within the ESR are not related with the total net GHG emissions mentioned in this figure, as these totals also include ETS and LULUCF emissions.

The emissions mark for Cyprus is outside of the scope of this figure with a 57% net and 58% gross increase in emissions.

Sources: EEA, 2024a, 2024b.

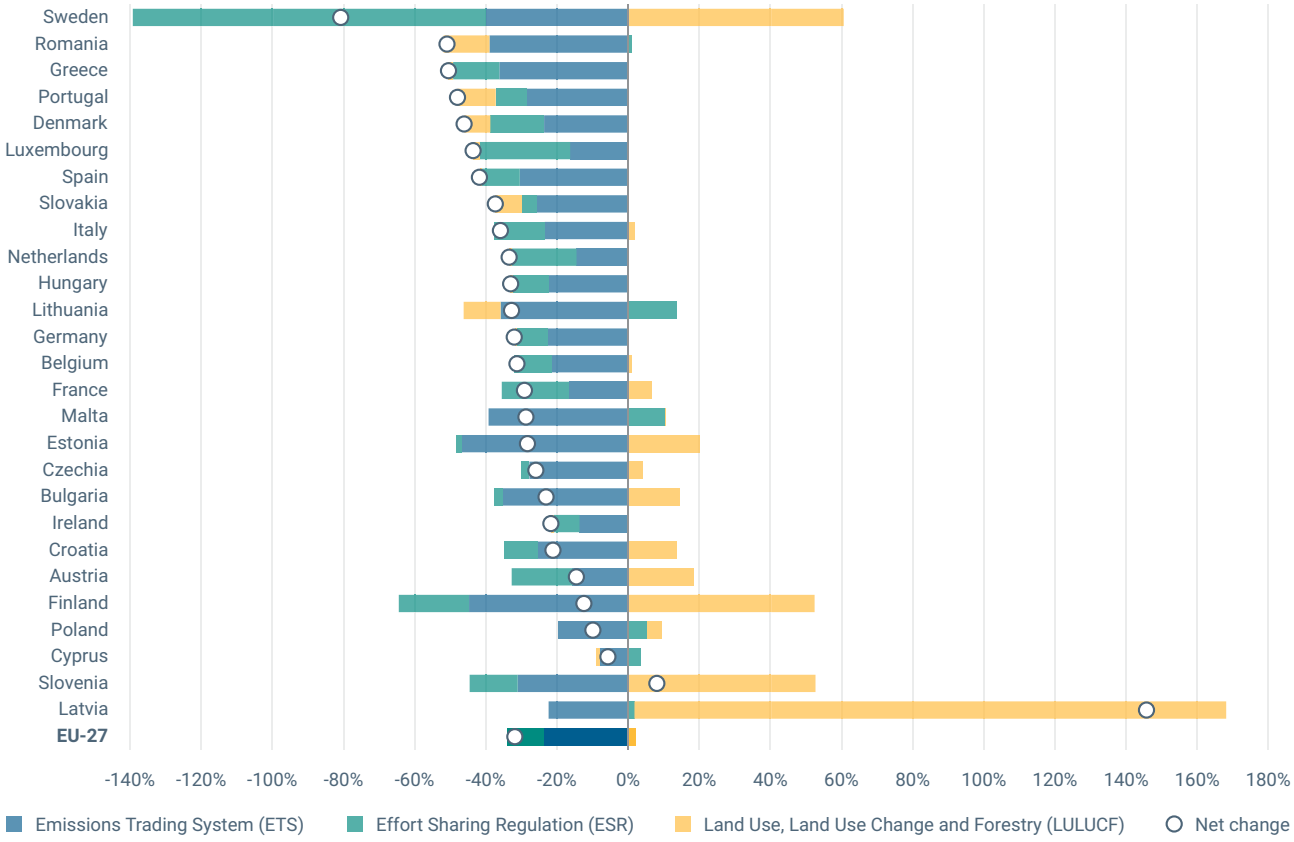
When focusing specifically on changes since 2005, the relative development of emissions covered by the ETS system, the ESR sectors and LULUCF can be evaluated for the different Member States. In line with the developments assessed in Figure 1.4, emissions under the ETS decreased the most across the board. An EU-average decrease in ETS emissions of 48% since 2005 translates to emissions reductions across all Member States, ranging from 70% in Luxembourg to 14% in Cyprus.

ESR emissions, on the other hand, decreased at a slower pace: by an estimated 19% at the EU level between 2005 and 2023, and ranging from -38% in Sweden to +31% in Malta compared to ESR base year emissions (see Figure 3.3). From 2005 to 2023, ESR emissions increased in six Member States (Cyprus, Lithuania, Latvia, Malta, Poland and Romania). Four of these countries (Latvia, Lithuania, Malta and Poland) had growth targets under the effort sharing decision for 2020 and still have higher

AEAs in 2023 than 2005 base year emissions. In all of these Member States, except Latvia, estimated ESR emissions are higher than AEAs in 2023.

As for GHG emissions and removals linked to LULUCF, in nearly half of the Member States the size of the net LULUCF sink has grown since 2005. However, the total net removals from LULUCF fell by 92 $MtCO_2e$., due to changes in other Member States, with the most notable shrinkage of the net LULUCF sink observed in France and Finland (at 32 and 24 $MtCO_2e$, respectively) ([7]).

Figure 3.2 **Evolution of ETS and ESR emissions and LULUCF removals and emissions per Member State, 2005-2023**



Notes: In this graph, absolute changes of ESR, ETS are expressed as percentage changes relative to the total net GHG emissions in 2005. In this way, the change in total net GHG emissions between 2023 and 2005 is broken down into the changes of emissions covered under these policy instruments.

Sources: EEA, 2024a, 2024b, EEA, 2024d.

([7]) LULUCF information is subject to considerable changes in GHG inventories due to recalculations. In light of this, these results might change with future inventories. In addition, 2023 estimates for this sector were not reported by all Member States.

3.2 Progress to national emission targets

National targets are set under the effort sharing and LULUCF regulations.

The ESR sets binding national emissions reduction targets to reduce GHG emissions by 2030 from domestic transport (excluding CO_2 emissions from aviation), buildings, agriculture, small industry and waste. The national 2030 reduction targets are expressed as a percentage change from 2005 emission levels and range from -10% to -50%. The 2030 national emissions reduction targets are translated into AEAs for each year in the period 2021-2030 based on a defined trajectory comprising binding annual emission limits for each Member State. Member States can use several flexibilities to comply with these targets.

Emission targets for 2030 have been made more stringent with the ESR revision in 2023, with a simultaneous decrease in AEAs for the years 2023-2029 (EU, 2023a, 2023h). Iceland and Norway have agreed to implement the ESR and commit to binding 2030 emissions reductions targets.

The ESR emissions of Member States are calculated annually based on the GHG inventory, while the final compliance calculations of ESR emissions for 2021-2025 will only be determined in 2027 based on a comprehensive ESR review. Until then, the ESR emissions of these years can shift with updates of countries' annual GHG inventories. In the inventory compiled in 2024, a small change to the 2021-ESR emissions was observed. At the EU level, the difference between ESR emissions and AEAs for 2021 increased by 12MtCO_2e compared with last year's inventory, while for Austria and Denmark, a small AEA deficit switched to a marginal surplus.

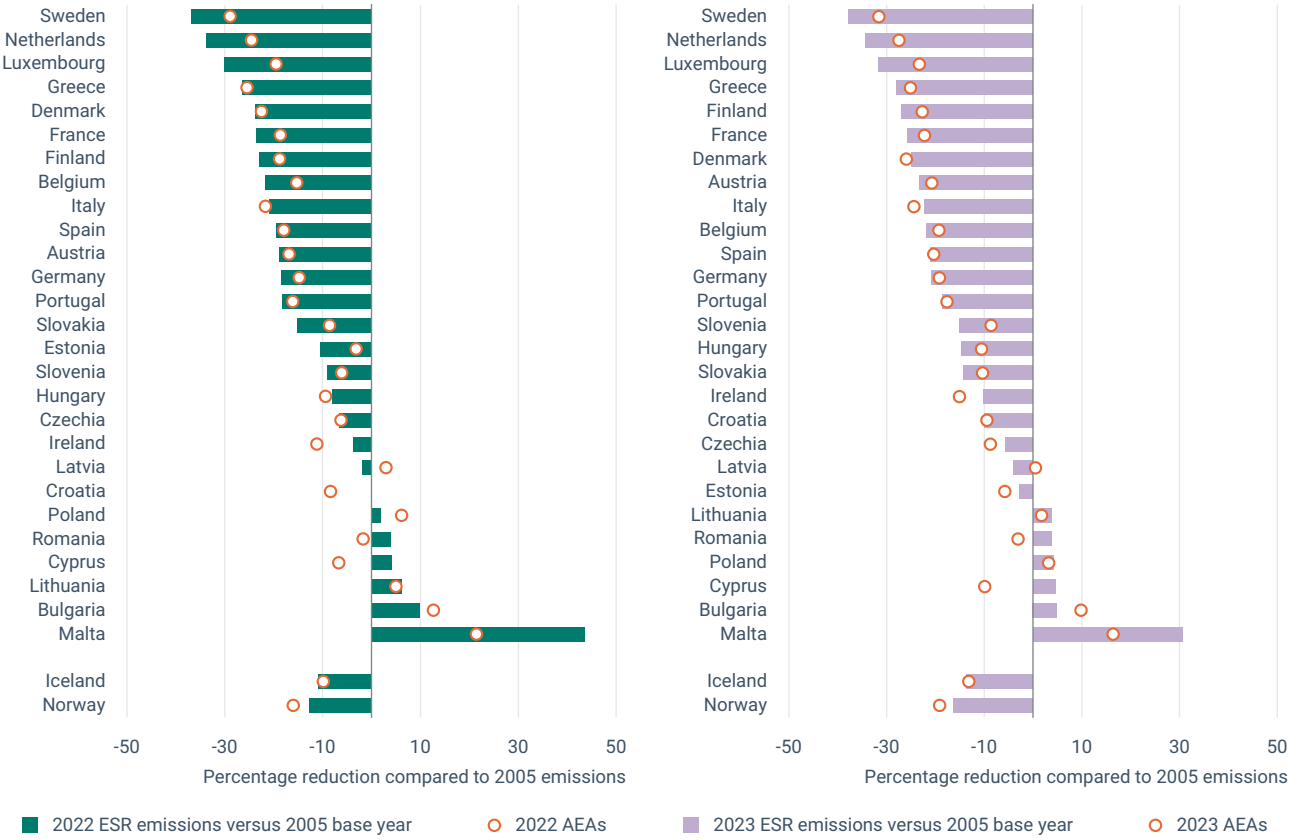
In 2022, emissions in the effort sharing sectors were lower than Member States' AEAs for all except eight Member States (Croatia, Cyprus, Hungary, Ireland, Italy, Lithuania, Malta and Romania).

Member States can use various flexibilities to reduce differences between AEA and ESR emissions. This can include the banking of emissions by a country for its own future use. The three Member States that had a deficit in 2021 according to the latest GHG inventory (Cyprus, Ireland and Italy) also show a deficit in 2022. For Croatia, the 2022 deficit is higher than the surplus of 2021, leading to a net deficit across both years. These Member States could not reduce their deficits in 2022 via the banking of surplus AEAs from 2021. For compliance, these Member States will either have to reduce their emissions in the following years to a higher extent than their AEA or have to use the borrowing flexibility, use Land Use Mitigation Units from the LULUCF Regulation if available, or purchase AEAs from other Member States. Compliance for each year from 2021-2025 will take place after the comprehensive review of ESR emissions in 2027. For details about the compliance cycle see the technical background document (EEA, forthcoming i) and Oeko-Institut (2024b).

With the latest revision of the ESR, from 2023 onwards the national target paths to 2030 became steeper for all Member States but Malta. Preliminary estimates for 2023 indicate that all but ten Member States (Cyprus, Czechia, Denmark, Estonia, Ireland, Italy, Lithuania, Malta, Poland and Romania) had effort sharing emissions lower than their AEAs prior to the use of flexibilities.

Iceland remained below its AEA in 2022, while ESR emissions in Norway exceeded their AEA. Preliminary estimates indicate that this picture remains the same in 2023.

Figure 3.3 **Emissions in the effort sharing sectors in 2022 and 2023 compared to the annual emission allocations**



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

Sources: EU, 2023a; EEA, 2024d.

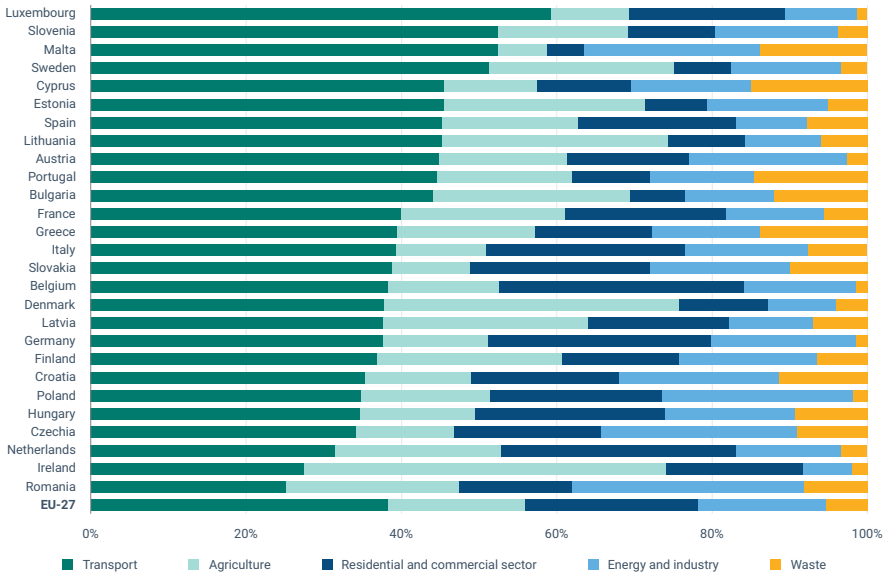
If ESR emissions in the projections scenario with existing measures are considered, all Member States except Greece and Portugal will have higher ESR emissions than their national reduction targets in 2030. This number is reduced to 22 Member States if additional policies and measures — as reported according to the Governance Regulation — are accounted for. On an EU level, the difference in 2030 totals up to 312 $MtCO_2e$ with existing measures and 160 $MtCO_2e$ with additional policies and measures. The ongoing update of the NECP is expected to contribute to further emissions reductions among the Member States.

Box 3.4

Sectoral shares under effort sharing

The ESR covers all GHG emissions not covered under the current EU ETS, apart from CO_2 emissions from domestic aviation. In 2022, the transport sector was the largest source of ESR emissions across almost all Member States. There are only three exceptions: in the Netherlands, the buildings sector is the most prominent; in Romania, it is the energy and industry sector; while in Ireland, agriculture has the largest share in ESR emissions, as illustrated in Figure 3.4.

Figure 3.4 Sectoral shares of emissions under the ESR in Member States



Sources: ETC calculation based on EEA, 2024a, 2024b.

Sweden, the Netherlands and Luxembourg were the three Member States with the largest emissions reductions in 2022 compared to 2005 (see Figure 3.3). The Netherlands and Sweden managed to have each effort sharing sector except agriculture reduce emissions by 29-56% and 35-65% respectively compared to 2005. In both countries, the agriculture sector exhibited emissions reductions compared to 2005 in the low single digits: 2% in the Netherlands and 4% in Sweden. Luxembourg had its largest effort sharing sector, transport, reduce emissions by 41% compared to 2005, while the energy and industry sector showed an increase of 32%.

The revised LULUCF Regulation (EU, 2023g) sets an EU-wide net removal target of an additional 42MtCO_2e for 2030, compared to the yearly average of the reference period of 2016-2018. The target is distributed among Member States through individual targets in a way that requires each Member State to increase its climate ambition in the land use policies. This will result in a total net removal of 310Mt CO_2e in 2030.

For 2021-2025 a national 'no debit' target has to be achieved, where EU Member States have to ensure that accounted GHG emissions from land use, land use change or forestry do not exceed total accounted removals. If the national net sink from LULUCF is higher than what is required under the LULUCF Regulation, these amounts can be used as one type of flexibility under the ESR.

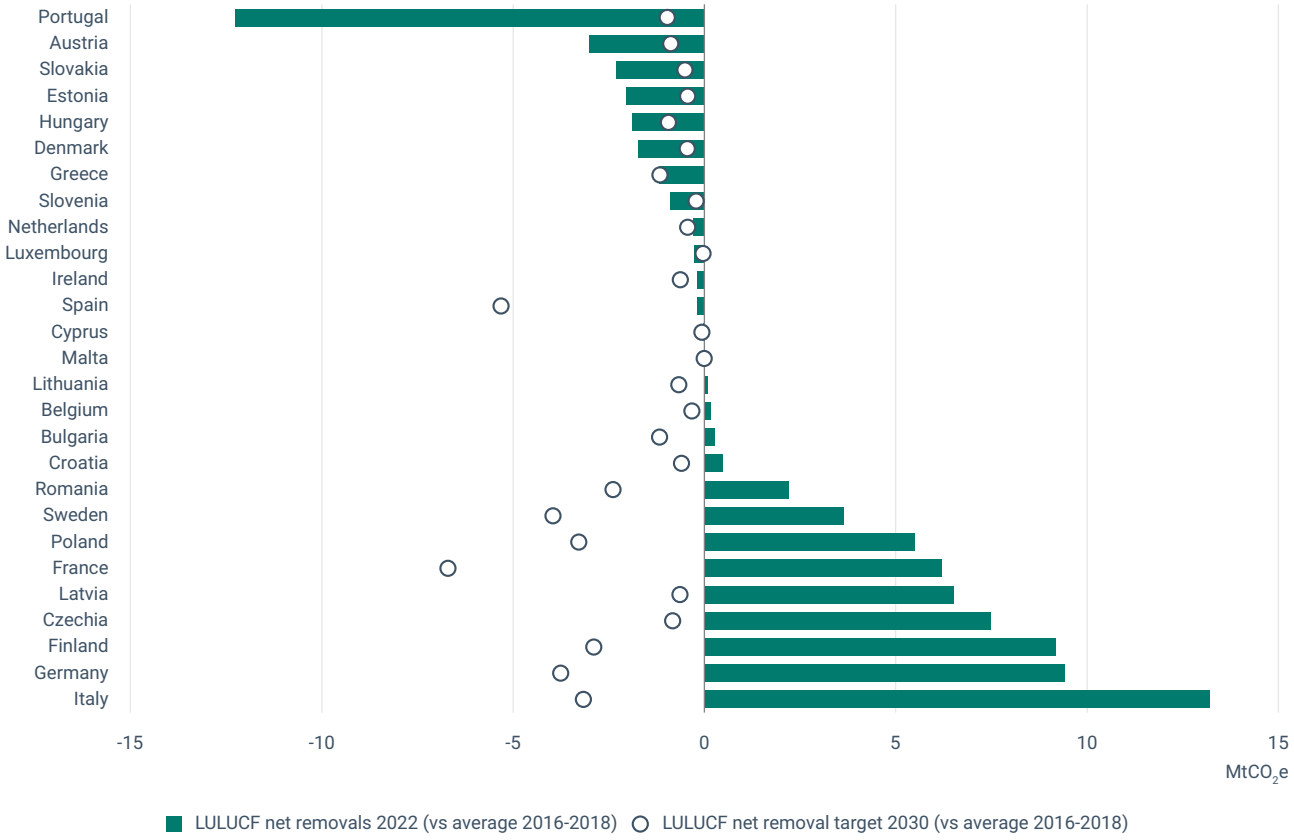
The reduction of the EU LULUCF sink in recent years is also reflected in trends observed across individual countries, as illustrated in Figure 3.5. When comparing the reported 2022 ([8]) net LULUCF removals of Member States to the 2016-2018 baseline, 13 countries show a decrease in removal capacity, despite all Member States having targets to increase this capacity by 2030.

Looking to 2030, nine Member States currently show a higher LULUCF net removal than their 2030 target. However, based on the information from projections with additional measures for 2030, three of those (Greece, Hungary and Slovakia) are expected to show a negative trend in the future, whereby their LULUCF performance in 2030 would be lower than their targets.

According to the same projections, three of the four Member States with the highest LULUCF net removals (Poland, Romania and Spain), will see their capacity to remove emissions decrease considerably. This illustrates that additional Member States' policies and measures in this sector are needed to ensure that the EU target is achieved.

([8]) 2022 information is displayed because estimated LULUCF information for 2023 has been gap-filled to a larger extent than other estimates.

Figure 3.5 Net LULUCF removals in 2022 compared to 2016-2028 average



Note: This figure illustrates the change in net LULUCF removals in 2022 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.

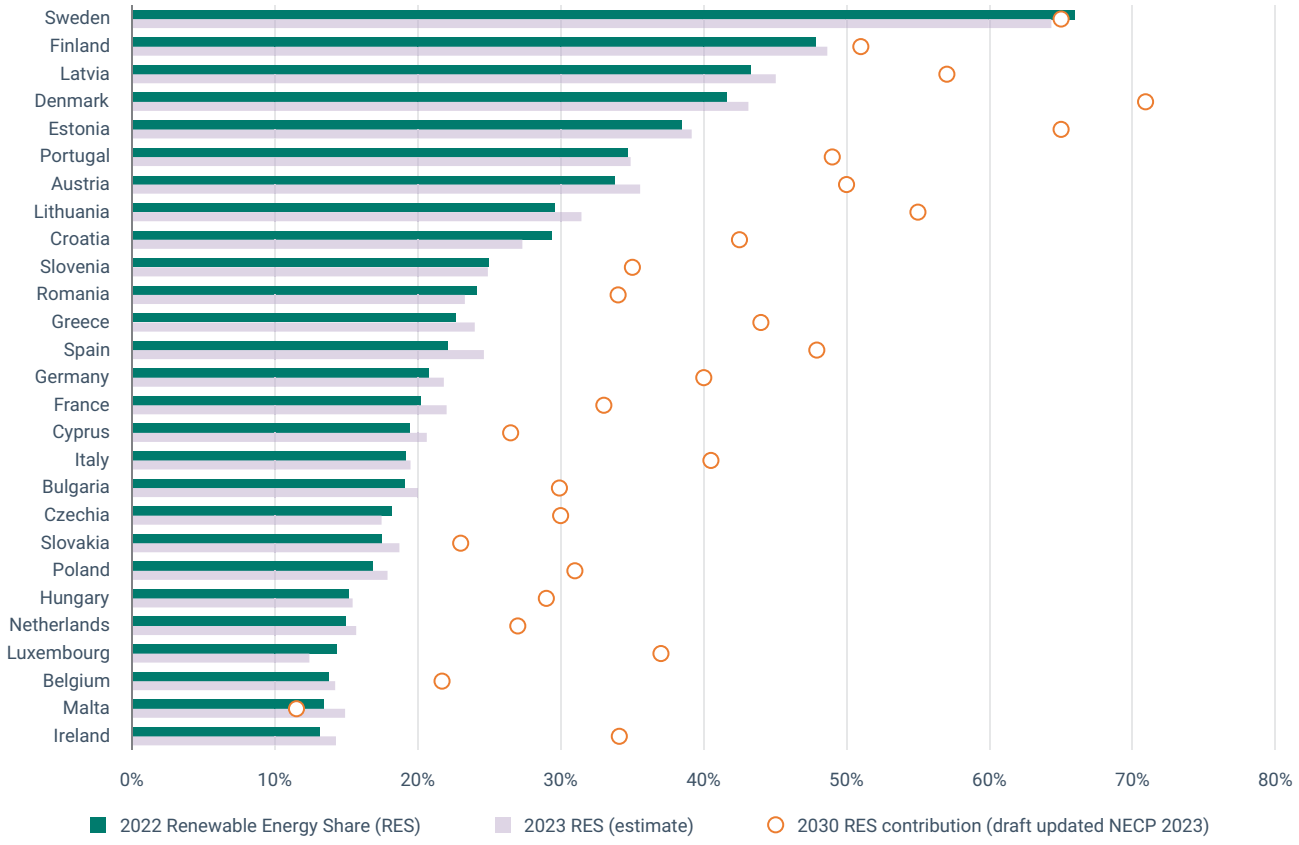
Sources: Based on EEA, 2024a and EU, 2023g.

3.3 Renewable energy

The Renewable Energy Directive raised the European target of a renewable energy share in 2030 from 32% to a minimum share of 42.5%, with the aim of reaching 45%. To achieve this objective, all EU Member States determine in their NECPs their individual contribution to the EU's overall 2030 renewable target, expressed as the share of gross final energy consumption. To do so, they have to put forward a value for 2030 (the contribution) and should set an indicative trajectory until then. Draft updated NECPs were submitted in 2023, final updated NECPs were due at the end of June 2024 and these will be assessed by the European Commission.

The development of renewable energy in Europe is not progressing evenly in all Member States. The EU's overall total renewable energy shares of 23% in 2022 results from shares ranging from 13% in Ireland and Malta to 66% in Sweden. To evaluate the progress made in 2022, this year's RES shares can be compared with the interim target outlined in the Governance Regulation (EU, 2018). This sets an interim 2022 trajectory reference point, requiring that 18% of the distance between the 2020 and 2030 contribution was achieved that year. Taking into account the previous EU RES target of 32% — which was still valid in 2022 — the EU as a whole reached the 2022 interim target, as did most Member States. However, for Austria, Belgium, France, Ireland, Italy, the Netherlands, Romania, Slovenia and Spain, the 2022 RES level was below the reference point ([9]). For three Member States (Austria, France and Ireland), the 2022 RES share was below their binding 2020 baseline.

Figure 3.6 **National progress in 2022 towards 2030 RES contributions and estimates for 2023**



Notes: Up to 2022, the data includes statistical transfers. The following Member States received statistical transfers in 2022: Belgium (1% on total renewable energy), Germany (0.01%), Luxembourg (22%) and Slovenia (8%). Only Denmark provided statistical transfers in 2022.

Sources: Eurostat, 2024c, EEA, forthcoming c, EC, 2020b.

([9]) Calculated between the 2020 target and the national contribution as reported in the first NECPs in 2019 and assessed in EC 2020.

Preliminary estimates for 2023 indicate that the total RES shares ranged from 12% in Luxembourg to 64% in Sweden ([10]). Twenty-one Member States saw an increase in their renewable energy shares between 2022 and 2023. The largest increase is estimated for Spain, which increased its RES share by three percentage points from 2022 to 2023. In contrast, the RES shares of Croatia, Luxembourg and Sweden are expected to have decreased by two percentage points compared to 2022.

Member States' 2030 RES share contributions — according to their draft updated NECPs submitted in 2023 (EC, 2023a) — range from 11.5% (Malta) to 65% (Sweden). Overall, the share of renewable energy in the final energy consumption could reach between 38.6% and 39.3% in 2030 at EU-level, according to the EU-wide assessment of the draft updated NECPs (EC, 2023c). As a result, Member States need to raise their contributions in their final updated NECPs (to be submitted in 2024) to collectively achieve the 2030 binding EU renewable energy target (EC, 2023c).

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([10]) These estimates for 2023 do not include any statistical transfers.

3.4 Energy efficiency

Under the Energy Efficiency Directive recast 2023/1791, the EU's 2030 target for primary energy consumption has been made more ambitious, with the consumption target decreased from 1,128Mtoe to 992.5Mtoe. The binding target for final energy consumption has also been made stricter, dropping from 846Mtoe to 763Mtoe. Member States contribute to the European targets by providing indicative national 2030 contributions for both final and primary energy consumption, accompanied by indicative trajectories for each.

When calculating the national contributions for both FEC (final energy consumption) and PEC (primary energy consumption) (EC, 2024a), a Member State has full flexibility on how this will be done, while respecting a comprehensive list of factors and national characteristics set out in the Energy Efficiency Directive (EED) (Article 4(3)). Importantly, Member States can use a formula to determine their contributions in a fair and feasible way (Annex 1 of the EED). Each Member State must guarantee that the ambition level of their contribution does not surpass the formula-derived value by more than 2.5%. Member States submitted their indicative national energy efficiency contributions before 30 June 2023. A final update, reflecting the new European targets for energy efficiency should be submitted in the corresponding Member State's final NECP.

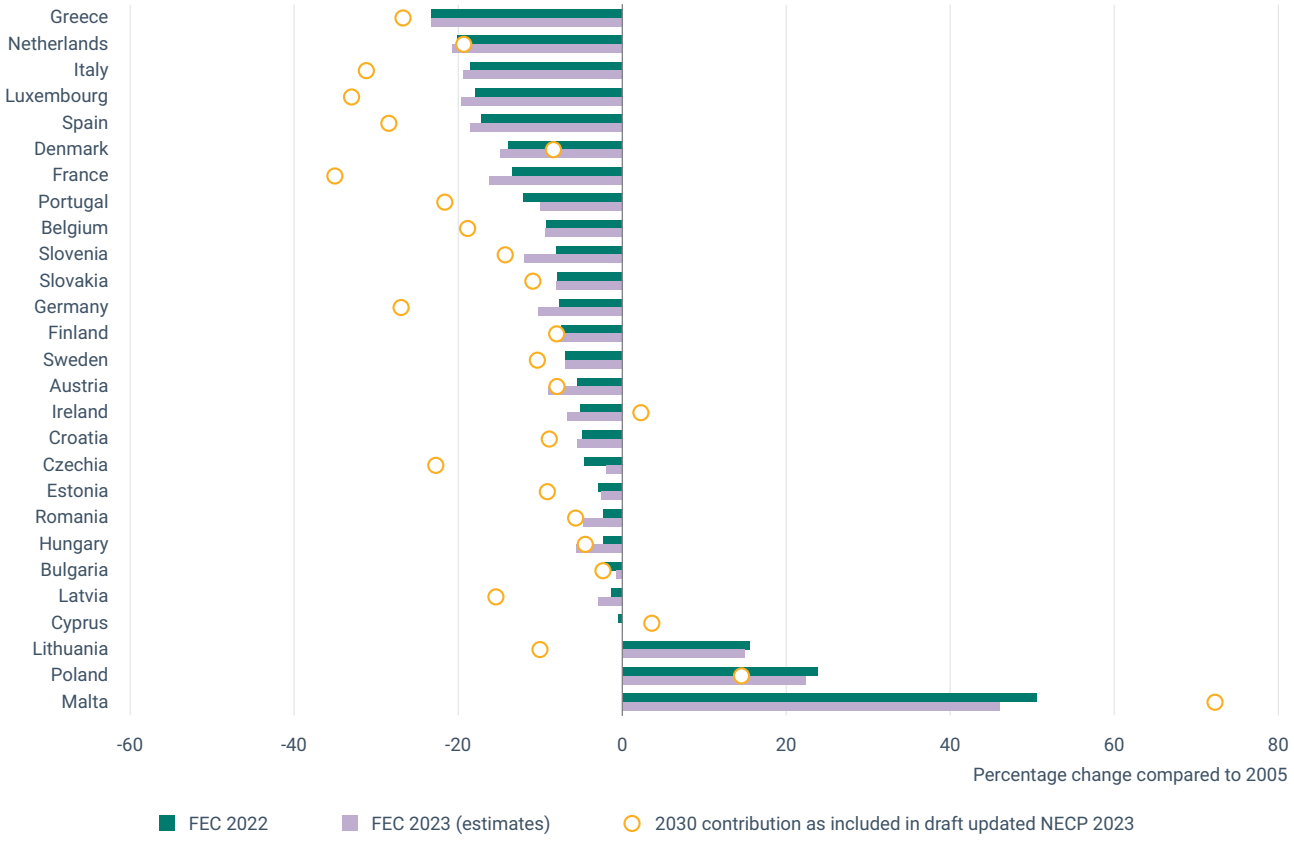
Looking at the historic evolution, the EU reduced its final energy consumption by 9.7 % between 2005 and 2022. A substantial part of this change took place in 2022, with the final energy consumption in the EU dropping by almost 3% compared with the previous year. This significant reduction in 2022 was among others driven by significant higher natural gas prices as a result of the energy crisis. This overall reduction since 2005 translates into a decreased final energy consumption in 24 Member States, with the strongest decreases in Greece, Italy, Luxembourg and the Netherlands. Three countries experienced an increase in final energy consumption between 2005 and 2022: Lithuania (+16%), Malta (+50%) and Poland (+24%) (see Figure 3.7). The significant increases in Lithuania and Poland are driven largely by the transport sector, which has seen massive increases of 54% and 98% respectively. In Malta, energy consumption increased over all sectors quite homogenously.

In 2022, total primary energy consumption in the EU was 16% lower than in 2005. Among Member States, only two witnessed an increase in primary energy consumption between 2005 and 2022: Cyprus (+0.3%) and Poland (+12%). The rest saw a decrease, with Greece (-31%), Italy (-23%), Lithuania (-22%) and France (-21%) showing the strongest declines.

According to 2023 preliminary estimates, 19 Member States saw a decrease in final energy consumption between 2022 and 2023, with Slovenia, Austria and Hungary reducing their final energy the most. Czechia, Portugal and Latvia saw the highest increase in final energy consumption in the same period, though their growth remained under 3%. Bulgaria, Estonia and Germany experienced the strongest drop in primary energy consumption. In contrast, nine Member States saw an increase in their primary energy for 2023, with the highest growths of 3% in France, Slovakia and Malta.

Member States' contributions to the energy consumption targets for 2030, according to their draft updated NECPs submitted in 2023 (EC, 2023a), are in total 7% (FEC) and 8% (PEC) higher than EU targets. This means that the final updated NECPs will need to include more ambitious energy efficiency contributions for 2030.

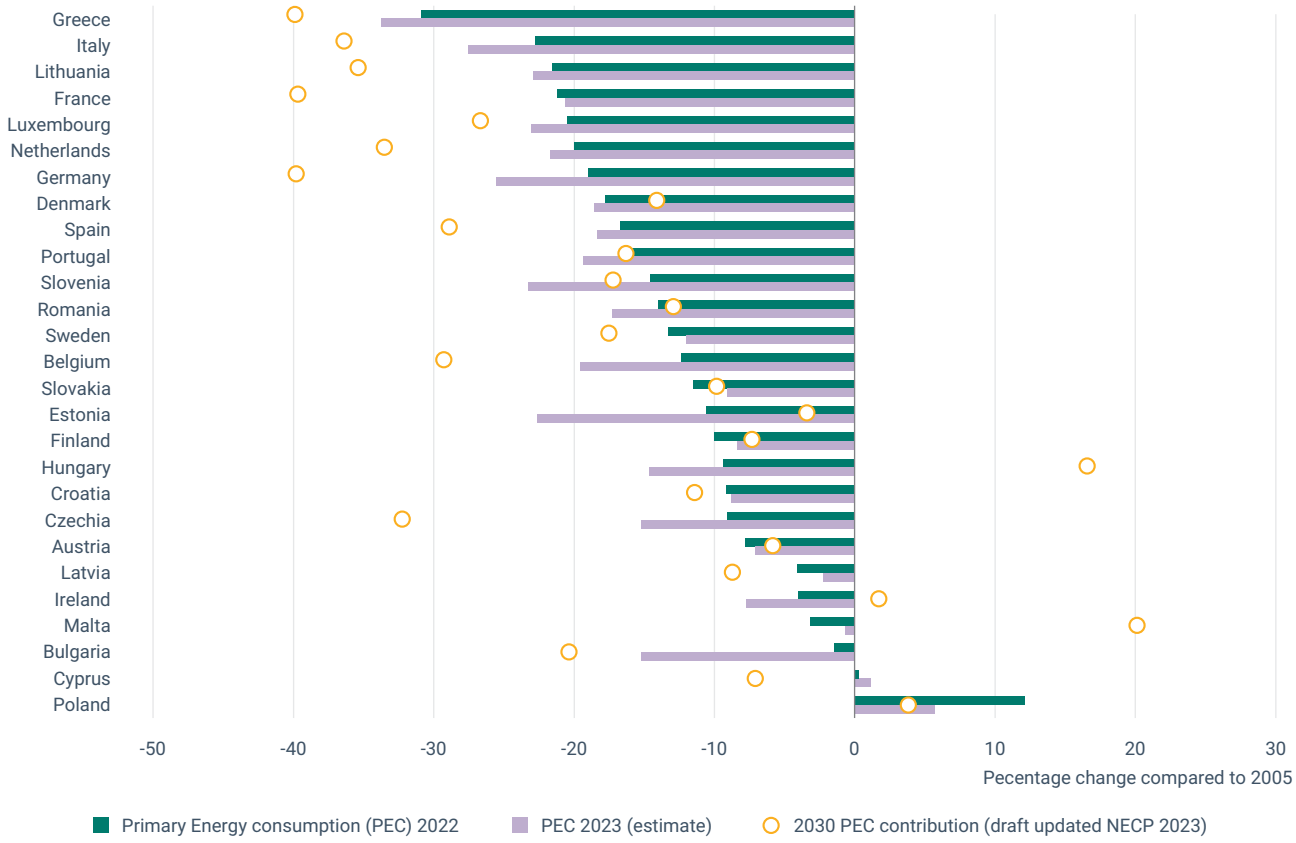
Figure 3.7 **National progress towards on final energy consumption**



Notes: To ensure comparability with the energy efficiency contributions, this indicator follows the Eurostat methodology for final energy consumption (Europe 2020-2030, FEC 2020-2030) and primary energy consumption (Europe 2020-2030, PEC 2020-2030).

Sources: EC, 2024a; Eurostat, 2024b; EEA, forthcoming b.

Figure 3.8 **National progress towards on primary energy consumption**



Notes: To ensure comparability with the energy efficiency contributions, this indicator follows the Eurostat methodology for final energy consumption (Europe 2020-2030, FEC 2020-2030) and primary energy consumption (Europe 2020-2030, PEC 2020-2030).

Sources: EC, 2024a; Eurostat, 2024b; EEA, forthcoming b.

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

The previous sections mainly describe progress among European Member States, but it is important to note that reporting on progress towards climate and energy targets — and membership or cooperation in the EEA and the European Environment Information and Observation Network (Eionet) — includes countries that are not members of the EU. Where available, information on GHG emissions, renewable energy and energy consumption is shown in the following sections for Iceland, Liechtenstein, Norway, Switzerland and Türkiye. In addition, all nine Contracting Parties to the Energy Community are considered where data are available.

Box 3.2

The Energy Community

The Energy Community is an international organisation bringing together the EU and nine Contracting Parties (Albania, Bosnia and Herzegovina, North Macedonia, Kosovo ([11]), Montenegro and Serbia, Georgia, the Republic of Moldova and Ukraine) to create an integrated pan-European energy market. The key objective is to extend the EU internal energy market rules and principles to the Western Balkans and the Black Sea region. This is achieved through adapting and adopting the EU legislation pertinent to the energy market.

A key aspect of this work is ensuring the availability of sufficient data and transparency on the progress of the climate and energy transition. Building on the EU Energy Union framework, the Contracting Parties increase their capacity to monitor progress in the areas of energy efficiency, decarbonisation, energy security and others.

The EEA collects and manages data from the nine Contracting Parties, providing support in this process. In 2023, several data streams were already reported by the parties — such as GHG policies and measures, adaptation planning and strategies and revenues from carbon price mechanisms — and by 2025, the scope of monitoring will expand to include GHG emissions, the share of renewable energy and progress in both energy efficiency and adaptation efforts. This approach ensures transparency in progress tracking and helps identify measures to accelerate advancements. In this way, the EEA also contributes to high-quality monitoring of climate and energy progress in neighbouring regions.

3.5.1 Greenhouse gas emissions in other EEA countries

Since 1990, GHG emissions (including emissions removals via LULUCF) in Iceland, Liechtenstein, Norway, Switzerland and Türkiye exhibited different trends. Iceland seeks to achieve climate neutrality before 2040 and plans to reduce GHG emissions from 1990 levels by 40% by 2030 (Iceland, 2023). The Paris Agreement requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve.

([11]) 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.

Iceland's latest update of its NDC is from 2021. It aims to reduce net GHG emissions by 55% by 2030, 'to be achieved by acting jointly with the European Union and its Member States and Norway' (Iceland, 2021). In 2022, Iceland's emissions were 11% higher than in 1990, mainly due to industrial growth in the interim period. Estimates for 2023 put emissions at 9% above the 1990 level.

Norway updated its 2030 target in its NDC in 2022 (Norway, 2022). It aims to reduce GHG emissions compared to 1990 levels by at least 55% by 2030, in cooperation with the European Union and its Member States as well as with Iceland. In its Climate Change Act, Norway set a 90-95% emissions reduction target compared to 1990 for 2050. According to this act, climate targets are to be reviewed every 5 years (Norway, 2017). In 2022, Norway's GHG emissions were 11% lower than in 1990; without LULUCF they were 5% lower than in 1990. With 2023 estimated emissions, the reduction was 17%.

Liechtenstein is aiming for at least a 40% reduction in GHG emissions by 2030 compared with 1990 levels (Liechtenstein, 2015), including emissions removals from LULUCF. Liechtenstein's Climate Strategy was adopted in 2022 and aims at climate neutrality by 2050. Since the energy sector plays an important role in Liechtenstein, plans involve reducing that sector's emissions by 50% by 2030. In 2021, GHG emissions in Liechtenstein were 78% lower than in 1990 (information for 2022 is not available at the time of writing this report).

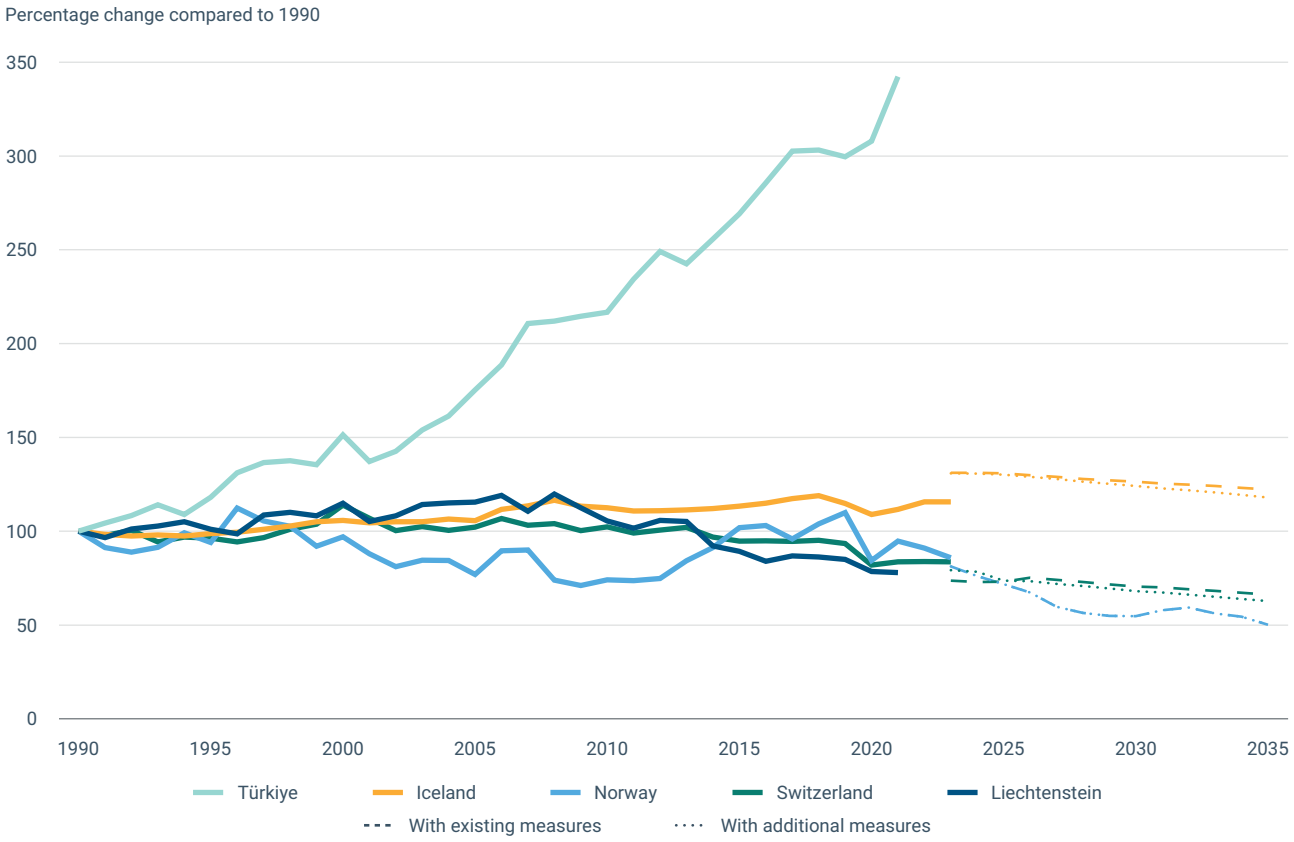
Switzerland updated its NDC in 2021, changing intentions from reducing emissions 'from minus 50 percent by 2030 to at least minus 50 percent by 2030'. Switzerland also increased its indicative goal for 2050 from a 70-85% reduction in GHG emissions to reaching net zero (Switzerland, 2021). In 2022, Switzerland had reduced its overall GHG emissions, including removals via LULUCF, by 19%. With the estimated GHG emissions of 2023, this figure increases to 21%.

Türkiye updated its first NDC in 2023 and now aims at reducing GHG emissions by 41% by 2030 against the business-as-usual scenario provided in its NDC, in which 2012 is considered the base year. This is 20% more than in its previous NDC. Türkiye intends for emissions to peak by 2038 and to achieve a net zero emissions target in 2053 (Türkiye, 2023). In 2021, Türkiye's GHG emissions were 238% higher than in 1990 and 38% higher than in Türkiye's base-year of 2012 ([12]). This increase is mainly related to the relatively high increase in population and energy consumption of the developing country with its growing economy.

([12]) Information for 2022 is not available at the point of writing this report.

Actual GHG emissions of the nine Contracting Parties of the Energy Community are currently not available. It is expected that the information will be included in future editions of this report with the new monitoring of energy and climate information starting in 2025.

Figure 3.9 **Total GHG emissions trends and projections in Iceland, Liechtenstein, Norway, Switzerland and Türkiye**



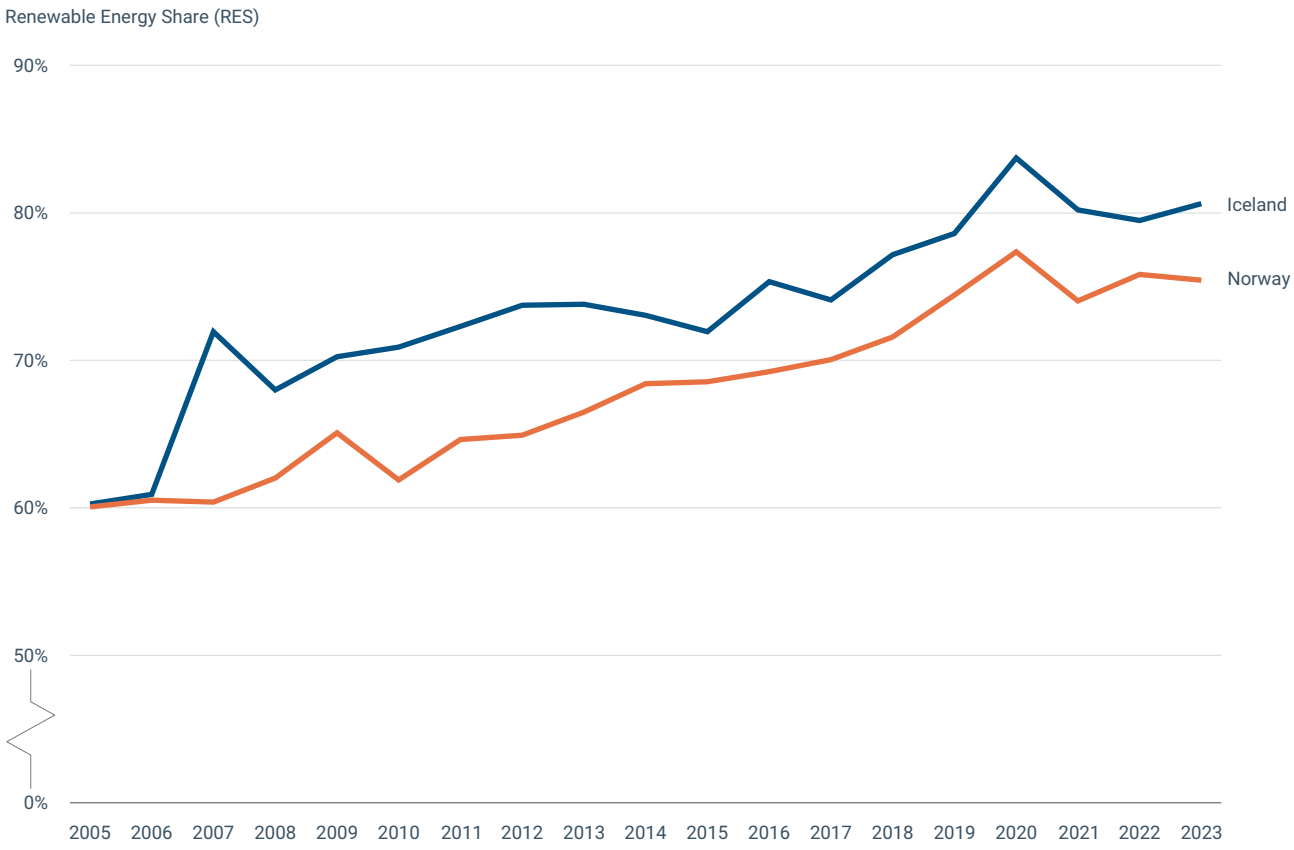
Source: EEA, 2023b, 2024a, forthcoming e.

3.5.2 *Renewable energy in other EEA countries*

Information on RES shares is available from Eurostat for Iceland and Norway (Figure 3.10). The two countries had high levels of renewable energy use between 2005 and 2022, both starting with levels of 60% in 2005. RES 'topped' in 2020 during the COVID-19 pandemic and fell to a lower share in 2021 (and 2022 for Iceland).

Preliminary estimates for 2023 indicate levels of 81% for Iceland and 75% for Norway.

Figure 3.10 Total RES shares in Iceland and Norway

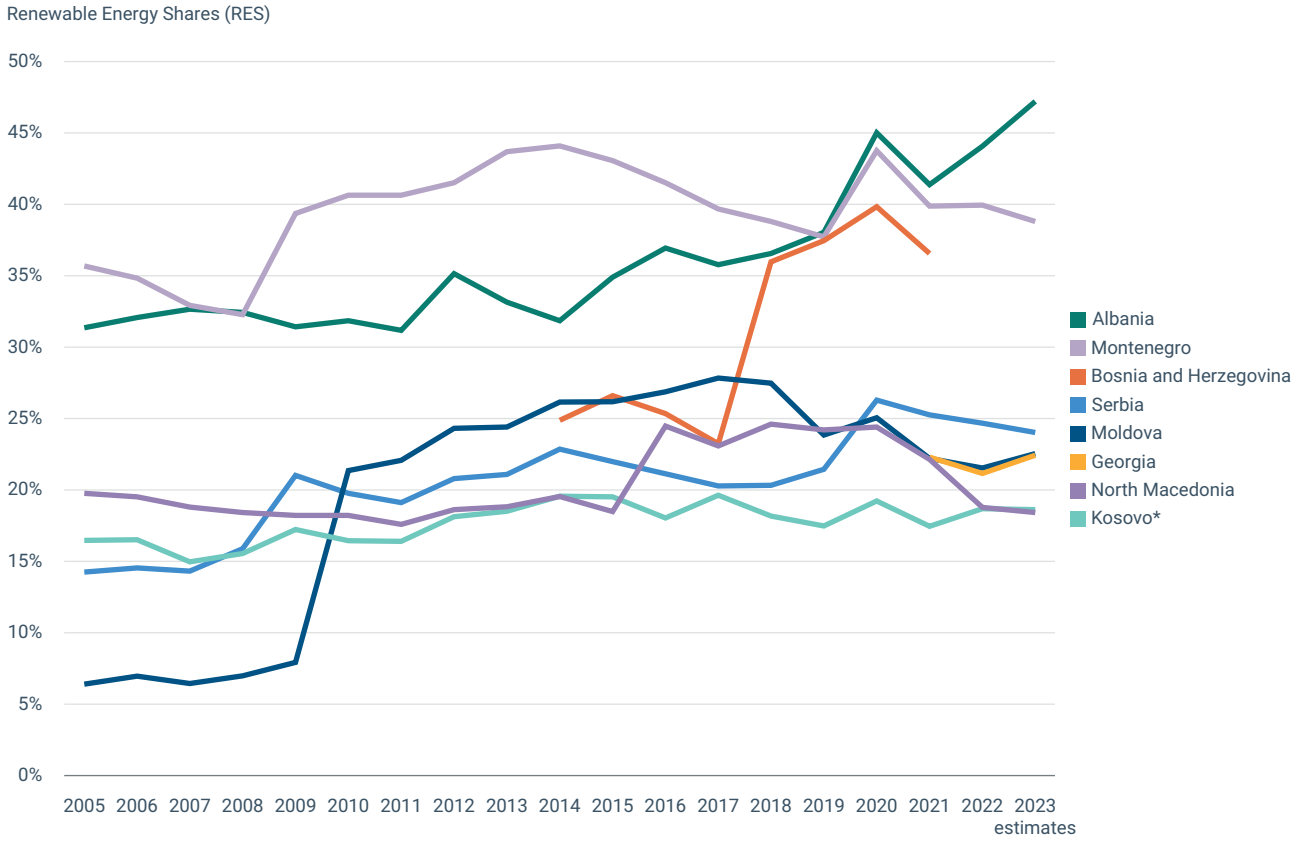


Source: Eurostat, 2024d; EEA, forthcoming c.

Renewable energy in the Energy Community Contracting Parties is available from Eurostat. Energy Community data monitoring and reporting will begin in 2025, with results to be included in future editions of this report.

Albania and Montenegro exhibit the highest RES shares of Contracting Parties over the period for which data are currently available. In Bosnia and Herzegovina, RES shares have been recorded since 2014 and the level grew quickly from 2017 to 2018 to now be close to the levels of Albania.

Figure 3.11 Total RES shares in Energy Community Contracting Parties



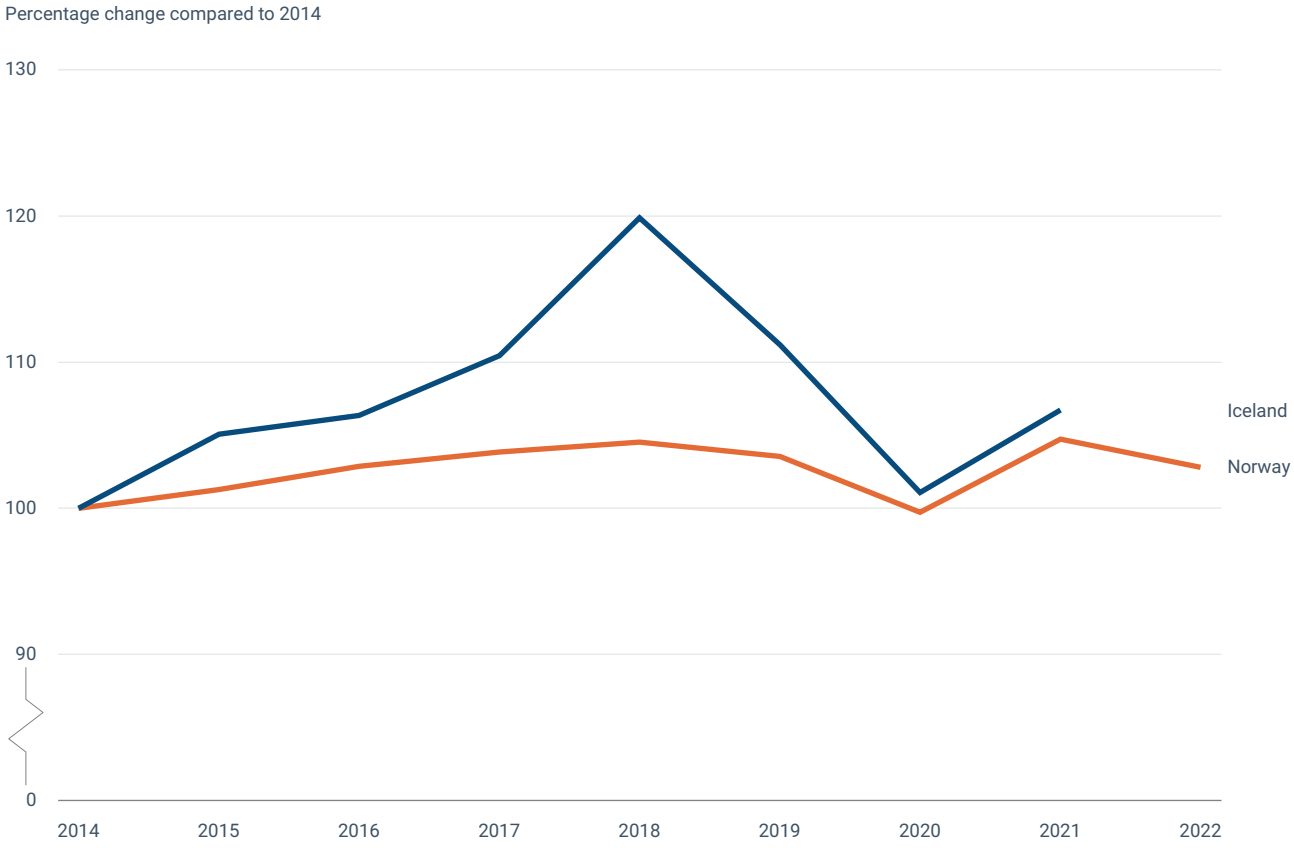
Note: *This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Source: Eurostat, 2024d; EEA, forthcoming c.

3.5.3 Energy efficiency for other EEA countries

Information on final energy consumption is available for Iceland and Norway for the full period since 1990. Between 2014 and 2022, final energy consumption increased by 7% in both countries, based on the latest information from Eurostat. From 2021 to 2022, final energy consumption decreased in Norway by 2%. No data for 2022 are available for Iceland.

Figure 3.12 Final energy consumption compared to 2014 for other EEA countries

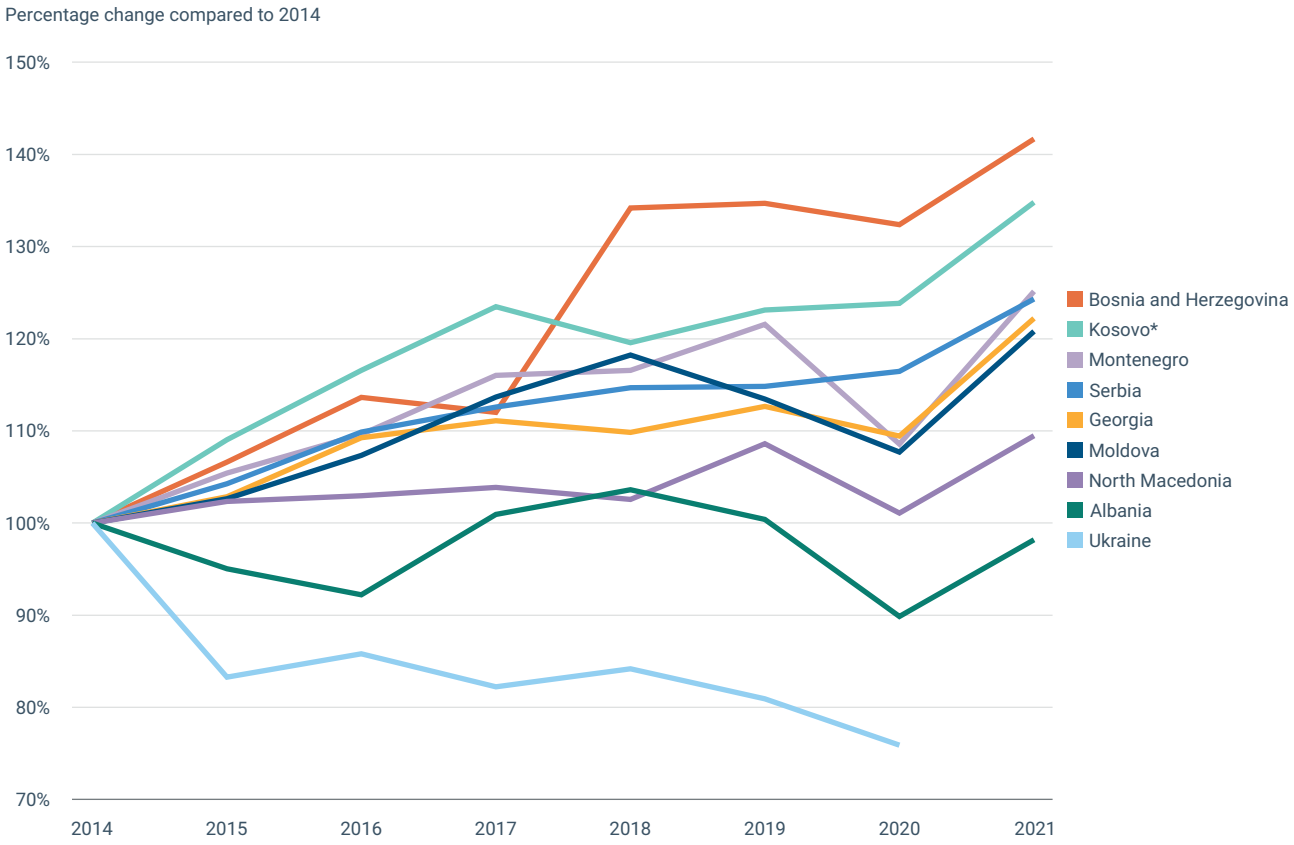


Source: Eurostat, 2024b.

3.5.4 *Energy efficiency in the Energy Community Contracting Parties*

For the nine Energy Community countries, some information on final energy consumption is available from Eurostat but starting from different years. This is expected to become more complete in future editions of this report with the new monitoring of Energy Community Countries that will start in 2025. Figure 3.13 therefore compares the development in all these countries starting in 2014, the first year with available data for all. Except for Ukraine (with missing data for 2021), the final energy consumption shows a more or less pronounced decrease in the pandemic year of 2020, followed by a rebound in 2021. The highest increase in final energy consumption since 2014 is visible in Bosnia and Herzegovina, while a considerable and close-to-steady decrease took place in Ukraine.

Figure 3.13 Final energy consumption compared to 2014 for Energy Community Contracting Parties



Note: *The Kosovo 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: Eurostat, 2024b.

4 Conclusions and further steps

As we have been reminded repeatedly over the past year — by everything from unseasonable heatwaves to extended droughts, unusually warm seas and unprecedented flooding and major storms — climate change continues to progress rapidly, with recent observations indicating accelerating warming. In some regions, climate change is advancing much faster, while feedback loops and non-linear developments can further accelerate these shifts, increasing associated risks.

In a similar fashion, emissions reductions and other forms of climate change mitigation are not linear, as 2023 has amply demonstrated. Last year, the EU made significant progress towards its 2030 climate targets. A sharp reduction in emissions brought the estimated emission level down to 37% below 1990 levels, as compared to 31% in 2022. This marks a return to a steep downward trajectory after years of fluctuating emissions levels because of the COVID-19 pandemic and the energy crisis. Considering the changes since 1990, emissions reductions have been accelerating over the decades, keeping the 2030 climate target and the broader goal of climate neutrality within sight.

Focusing on the sectoral developments in 2023, the energy supply sector has been the most significant contributor to emissions reductions. While historically the largest source of emissions in the EU, this sector shed this status by reducing its emissions by a substantial 19% over just 1 year. While a slight decrease in energy production played a role, the majority of the change is attributed to a decrease in emissions per unit of energy produced. This was mainly driven by the increase in nuclear energy, hydropower and the continued expansion of wind and solar power. The transformation of the sector continues at a rapid pace, fundamentally changing how energy is produced. Additionally, shifts in how energy is consumed have also lowered emissions, particularly in the industry and building sectors. 2023 saw estimated energy consumption and emissions in buildings decrease compared to the previous year, resulting in a 6% drop in emissions.

The transport sector has been slower to change. While road transport rebounded fully from the COVID-19 crisis, the uptake of electric vehicles slowed in 2023. After nearly doubling from 2021 to 2022, EV sales increased by only one percentage point in 2023, to 23.6%. Multiple factors contributed to this slowdown, but new vehicle models and policy tools like the new ETS2, which will incentivize electric driving, could drive renewed emissions reductions in the future. Nevertheless, the slower growth in EV adoption — and similarly in heat pumps — is a reminder that the transition will not happen automatically and requires continuous support. Considering non-energy-related emissions, the agriculture sector reduced its emissions by 2% in 2023, while preliminary estimates for LULUCF indicate an increase in GHG removals.

These sectoral trends are reflected in emissions covered by policy instruments. Emissions from stationary installations covered by the ETS are nearly 50% below 2005 levels in 2023, on track to meet the 2030 target of a 62% reduction if the recent trends continue through to the end of this decade. However, preliminary figures for the ESR are less promising. Aggregate emissions in 2023 are 19% below 2005 levels, while the 2030 target requires a 40% reduction. Although EU-wide emissions in 2023 remain below the trajectory, several countries are already falling short of their targets. Additional efforts will also be necessary to meet LULUCF goals, with recent trends suggesting challenges to achieving 2030 targets.

The latest developments documented in this report highlight the need for sustained efforts to reduce emissions across the EU and progress towards climate neutrality. With the major legislative framework for 2030 now in place, attention can shift entirely to implementation to achieve targets. Member States hold crucial levers to steer policy in the right direction and the update of the NECPs is contributing to clear national policy frameworks across all dimensions of the Energy Union. Success in certain sectors and the rapid transition in specific countries demonstrate that significant emission reductions are achievable. However, continued focus and action will be necessary to maintain momentum and ensure that the EU remains on track to meet its climate goals.

Abbreviations

AEA	Annual emission allocation
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
CO_2	Carbon dioxide
EC	European Commission
EEA	European Environment Agency
EED	Agency Energy Efficiency Directive
ESR	Effort Sharing Regulation
ETC CME	European Topic Centre on Climate Change Mitigation and Energy
ETS	Emissions Trading System
EU	European Union
EU-27	27 Member States of the European Union (post-Brexit)
FEC	Final energy consumption
GHG	Greenhouse gas
GW	Gigawatt
GWP	Global warming potential
Mtoe	Megatonnes of oil equivalent
LULUCF	Land use, land use change and forestry
$MtCO_2e$	Million tonnes of CO_2 equivalent
Mtoe	Million tonnes of oil equivalent
NECP	National energy and climate plan
PEC	Primary energy consumption
RED	Renewable Energy Directive
RED II	Recast Renewable Energy Directive
RES	Renewable energy source
WAM	With additional measures
WEM	With existing measures

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European Environment Agency

Trends and projections in Europe 2024
2024 — 66 pp. — 21 x 29.7 cm

ISBN: 978-92-9480-685-7
doi: 10.2800/7574066

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Publications Office
of the European Union

TH-01-24-009-EN-N
doi:10.2800/7574066