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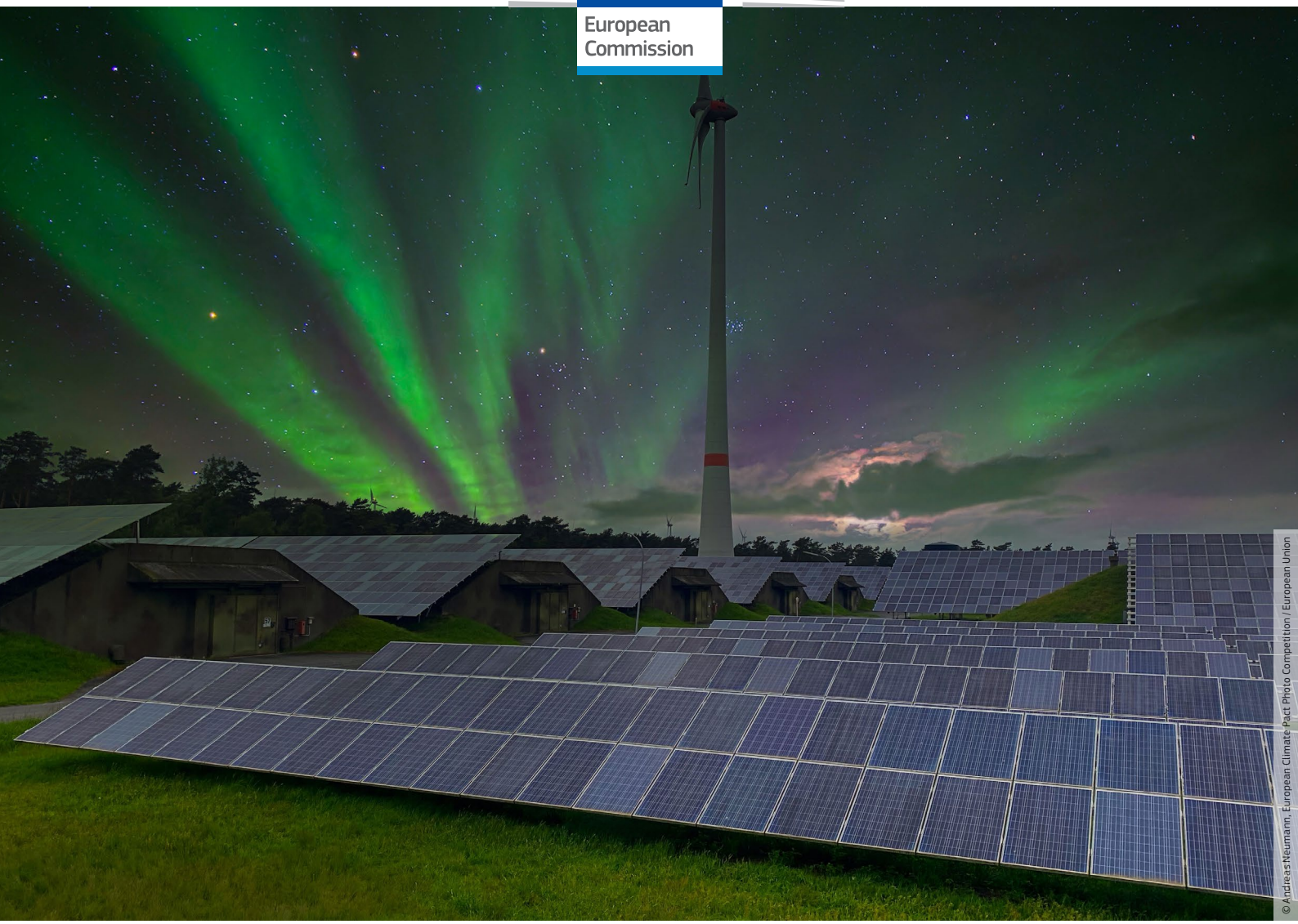

Progress Report 2024

Climate Action

Leading the way: from plans to implementation

for a green and competitive Europe

Climate Action

Acknowledgement

The Climate Action Progress Report features photographs from the 2024 European Climate Pact photo competition, which encouraged individuals to capture what they are doing for the climate at home, in their communities and cities, and share their stories of action.

More than 300 entries illustrated the wide range of actions being taken across Europe and how all of them, no matter how big or small, can have a positive impact.

A five-person jury representing both the European Union and the Climate Pact selected nine winners, and a tenth winner was chosen by over 4000 people in a public vote. The winning photos illustrate action ranging from changing the way you cut your grass to organising a community clean-up event and building a sustainable home.

Launched by the European Commission as part of the European Green Deal, the Climate Pact is a movement of people united by a shared mission to tackle climate change and help the EU to become climate-neutral and resilient by 2050.

With a network of more than 800 European Climate Pact Ambassadors and 50 Partner organisations, the Pact brings together people, communities and organisations from across Europe to learn more about climate change and be empowered to act.

EUROPEAN COMMISSION

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"The EU is leading the way in the clean transition, with another year of strong greenhouse gas emission reductions in 2023. The EU now represents 6% of global emissions. As we head off soon to COP29, we once again demonstrate to our international partners that it is possible to take climate action and invest in growing our economy at the same time. Sadly, the report also shows that our work must continue, at home and abroad, as we are seeing the harm that climate change is causing our citizens."

Wopke Hoekstra

Commissioner for Climate Action European Commission

Foreword

The annual Climate Action Progress Report is a good occasion to reflect on progress made in the last 12 months.

This latest edition confirms that the EU is making good progress towards its climate goals, with significant emissions reductions. Net greenhouse gas emissions in the EU fell by a remarkable 8% in 2023 compared to 2022, the largest cut in several decades (excluding the exceptional fall during 2020 due to the COVID-19 pandemic). Increased renewable energy production at the expense of coal and gas generation was the primary driving force, although sizeable reductions were achieved by industrial sectors too. These findings are very promising and by maintaining this pace of mitigation, the EU can reach its 2030 targets.

There is no time to lose. The growing impacts of climate change are a stark reminder of the urgency and rationale for climate action. Summer 2024 was the warmest on record. Central Europe, Northern Italy and Southern Spain have been devastated by extreme flooding while unprecedented heatwaves gripped much of southern Europe and wildfires ravaged over 370 000 hectares of forest in the first nine months of the year. Rising global tension and geopolitical uncertainty make the case even stronger for building the EU's resilience and for investing in a competitive net zero economy.

The EU will stay the course on the European Green Deal. President von der Leyen made this crystal clear in her Political Guidelines for the next European Commission mandate. The European Commission will implement the ambitious climate policies democratically agreed in the past few years and will complement this with a Clean Industrial Deal in order to enhance Europe's competitiveness. The European Green Deal will act as an investment and innovation strategy to modernise our industry and make our economy fit for a changing world and a less secure future. In doing so, we will ensure that no person or region is left behind along the way.

The Draghi report, which underscores that decarbonisation can and should be a driver for competitiveness, provides a detailed roadmap for Europe. By boosting European innovation, better coordinating climate and competitiveness policies and investments, enhancing security and reducing our dependencies on critical materials, we can secure and sustain a prosperous future is attainable.

The EU Emissions Trading System (ETS) remains the cornerstone of EU climate policy, capping greenhouse gas emissions, providing a price incentive not to pollute and generating essential funds to innovate, lower emissions and support vulnerable households and microenterprise through the transition.

The EU ETS raised EUR 43.6 billion in auction revenue in 2023, an increase of over 11% on 2022, split between the budgets of Member States, the Innovation Fund, the Modernisation Fund and the Resilience and Recovery Facility, which together enable an effective and just transition. Member States are now required to spend the entirety of their ETS revenues on climate action, ensuring greater investment in the transition.

Emissions in the Effort Sharing (ESR) sectors decreased by 2% in 2023 compared to 2022. However, projections of ESR emissions, including additional measures, point to a shortfall in achieving the 40% target by 3 percentage points. It will require Member States to step up their efforts.

The land use, land-use change and forestry (LULUCF) sector absorbs more greenhouse gases than it emits. The EU has set a target of removing an additional 42 million tonnes of CO_2 equivalent ($MtCO_2$-eq) from the atmosphere by 2030. However, according to Member States' latest projections, the EU is set to miss this target by between 45-60 $MtCO_2$-eq. Also here, additional action is needed from our Member States to ensure an adequate level of carbon removals so as to stay on track towards climate neutrality in 2050.

While reducing emissions is the first best option to mitigate climate change, we also need to better prepare for the unavoidable impacts. While implementation of the 2021 EU Adaptation Strategy is well underway, the first-ever European Climate Risk Assessment report of March 2024 identified eight major climate risks (of 36 assessed) that require urgent action now. These include damage to coastal and marine ecosystems, exposure of the population to heat stress and pluvial and fluvial flooding.

Despite slow progress in some sectors, we are taking steps to address the most existential challenge the world is facing. We will turn the challenge into a unique opportunity for the EU to continue leading in the transition to climate neutrality and resilience. This year's report confirms that the EU's approach is working for the good of the climate, people and our economy.

The science is clear; climate change is hurting our planet, undermining future well-being and generating larger and more frequent disaster events. At the same time, we know that the worst potential consequences can be avoided with increased ambition and strong and coordinated action. And we know that the European Green Deal is the EU's most compelling growth, investment and innovation strategy amid a global race to net zero. The EU now accounts for about 6% of global GHG emissions. We continue working with all parties to the Paris Agreement to join us in taking ambitious action now to keep the 1.5°C goal alive. With a shared purpose and concrete efforts, we can ensure prosperity for all within planetary boundaries.

Kurt Vandenberghe

Director-General
for Climate Action

CHAPTER 1

Emission trends & progress in climate action

The 'Walls of Kindness'
by Angeliki Charalampidou, Greece

"The 'Walls of Kindness' is a voluntary action developed in neighbourhoods of my hometown Kastoria, Greece. Volunteers place wooden handmade hangers on abandoned walls around the city, and those that don't need some of their clothes anymore hang them there. This action supports the reuse of materials (wood and fabric) that would otherwise be thrown away. Reuse is the most environmentally friendly and efficient way to extend the life of clothes, as it requires the least additional resources and energy. The benefits of the Walls of Kindness are environmental, but also economic and social, since they offer goods to citizens who aren't able to buy them."

Key highlights

- Greenhouse gas emissions in the EU fell by 8% in 2023 compared to 2022. This is the largest annual fall in several decades excluding the year of pandemic, with emissions now 37% below their 1990 level and a GDP that has grown by 68% over the same period.
- The emissions reduction in 2023 is linked to the acceleration of the energy transition, and it is mostly driven by the increase of renewable energy production. This increases the confidence that the EU can meet its climate targets in a fair and competitive manner.
- Going forward, an emission reduction of 134 $MtCO_2$-eq per year (about 2.8 percentage points of 1990 emissions, or 4.5% of 2023 emissions) needs to be achieved on average from now until 2030. A preliminary analysis of the 14 final updated National Energy and Climate Plans (NECPs) submitted at the time of drafting this report points to a significant reduction of the remaining gap to the EU's 2030 target of 55%.
- The EU is focused on the full implementation of the legal framework for 2030 and ensuring the supporting investment flows in view of achieving a climate neutral and resilient EU by 2050.
- As global warming continues to accelerate with increasingly devastating effects, climate action needs to be sustained. EU decision makers agreed on important measures to meet the 2030 climate goal of -55% net GHG emission reduction, and the Commission recommended a 2040 target of net 90%, together with a Clean Industrial Deal, as well as ways to address the findings of the first EU Climate Risk Assessment to increase preparedness. Decarbonisation and climate resilience are increasingly determining factors of competitiveness, prosperity and security, especially for the EU which is almost entirely dependent on imports for its fossil fuel consumption.
- The EU has continued to inject resources into green transition to support people and wellbeing. Households and workers, especially from disadvantaged regions, are more and more involved in support programmes, as well as firms in EU-funded projects for developing innovative clean-tech solutions.

1.1 Climate change and greenhouse gas emissions: recent trends

The pace of anthropogenic global warming continues to accelerate and is impacting all regions of the world, with Europe warming twice as fast as the global average[1]. To limit warming to the 1.5 °C Paris Agreement temperature target, secure a liveable future for all, and avoid the worst impacts of climate change, global greenhouse gas emissions should fall by 43% below 2019 levels by 2030 and by 84% by 2050[2]. Climate change makes extreme events, including deadly heatwaves, extreme rainfall, hurricanes, forest fires and droughts more frequent and intense[3]. After 60 000 – 70 000 heat-related deaths in Europe in 2022[4,5], heatwaves in 2023 killed nearly 50 000 Europeans[6].

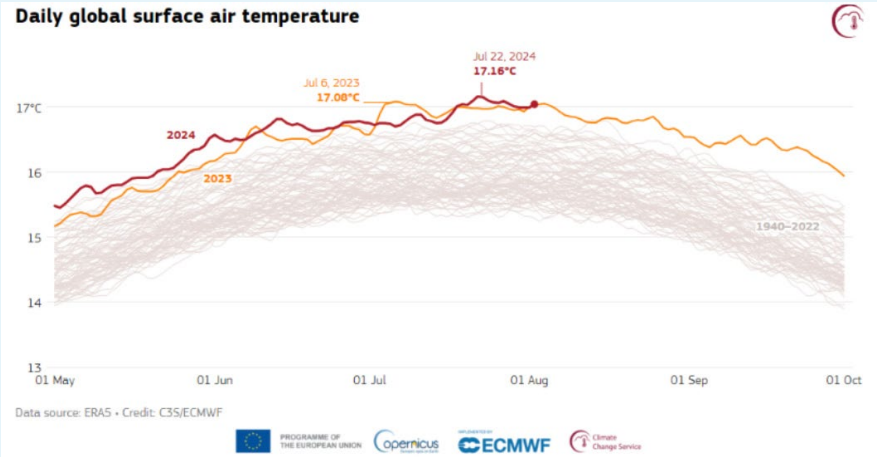
More catastrophic events took place in 2024 and projections show a strong net increase in temperature-related mortality rates already for mid-century[7]. The deadly floods in Afghanistan, which killed at least 300 people in May 2024, were followed by dangerous, intense and extended summer heatwaves that affected hundreds of millions of people globally. At least 10 countries recorded daily temperatures of more than 50 °C[8]. Temperatures of over 40 °C were recorded in many places in Europe, with Greece, Spain, France, Italy and Portugal experiencing extreme heat that caused fatalities, fuelled wildfires, and required emergency

1 Copernicus, European State of the Climate: Summary 2023, 2024. https://climate.copernicus.eu/sites/default/files/custom-uploads/ESOTC%202023/Summary_ESOTC2023.pdf
2 IPCC, Climate Change 2023: Synthesis Report - Summary for Policymakers, IPCC, Geneva, 2023
3 3 European Climate Risk Assessment (EUCRA) report. https://www.eea.europa.eu/publications/european-climate-risk-assessment
4 Ballester J. et al., 'Heat-related mortality in Europe during the summer of 2022' Nature Medicine, No 29, 1857-1866, 2023.
5 Commission Communication on managing climate risks, March 2024
6 Gallo et al., Heat-related mortality in Europe during 2023 and the role of adaptation in protecting health. Nature Medicine, 2024. https://www.nature.com/articles/s41591-024-03186-1
7 www.exhaustion.eu
8 World Meteorological Organisation (WMO). Extreme heat continues throughout July with devastating impacts. 8 August 2024. https://wmo.int/media/news/extreme-heat-continues-throughout-july-devastating-impacts

measures to protect the population from heat stress[9]. In September storm Boris caused catastrophic flooding in several European countries, while wildfires in Portugal caused fatalities. Urgent and decisive climate action is needed to save lives and livelihoods, avoid economic losses and safeguard natural systems.

Temperature records continue to be broken in 2024

The summer of 2024 was the hottest summer recorded and 2024 is on track to be the warmest year on record[1]. August 2024 was the warmest August recorded, marking the 15th consecutive month of record-high global temperatures[2]. 22 and 23 July 2024 were the hottest days since records began. Equally worrying, the oceans have also been warming at unprecedented rates. Sea surface temperatures reached record highs for the respective month of the year for 15 the consecutive months prior to July 2024, which was itself only 0.01 °C below the July 2023 value. About a fifth of the world's ocean surface is particularly vulnerable to the simultaneous onset of extreme heat, deoxygenation (due to relative increase in dissolved CO_2) and acidification. These compound events now are six times more intense and last three times longer than in the early 1960s. Even the transition from the El Niño event to La Niña, which is likely to start in 2024 and has a cooling influence, cannot counteract the anthropogenic warming, and the past 9 years have been the warmest on record even with the multiannual La Niña event.



Daily global-average surface air temperature for 2024 (red), 2023 (orange), and all years between 1940 and 2022 (grey). To see the most recent version of this chart, visit Climate Pulse. Data source: ERA5. Credit: Copernicus Climate Change Service /ECMWF.

1 Copernicus. World's warmest August completes hottest boreal summer on record, 9 September 2024. https://climate.copernicus.eu/worlds-warmest-august-completes-hottest-boreal-summer-record
2 WMO. Record-breaking temperatures continue in August. 13 September 2024. https://wmo.int/media/news/record-breaking-temperatures-continue-august

Despite years of warnings from the scientific community that greenhouse gas emissions need to decline rapidly to net-zero if we are to halt global warming, preliminary Joint Research Centre (JRC) data[10] show that global greenhouse gas (GHG) emissions (excluding the net removals from land use, land use change and forestry, LULUCF) have reached 53 billion tonnes of CO_2 equivalent (CO_2-eq) in 2023. This is 1.9% above the 2022 level and 3.3% above pre-pandemic (i.e. 2019) emissions (Figure 1.1.a). In 2023, transport was the main driver of increased global emissions (+3.7%, or 301 $MtCO_2$-eq) and now surpasses the pre-pandemic level. It was followed by the power industry (+1.6%, or 234 $MtCO_2$-eq) and industrial combustion (+2.9%, or 184 $MtCO_2$-eq). Among the larger emitters (Figure 1.1.b), the most significant increases were in China (+5.2%, or 784 $MtCO_2$-eq) and India (+6.1%, or 236 $MtCO_2$-eq). Compared with 1990 levels, the EU's GHG emissions have decreased more significantly than those of all the other top emitting economies. The decades-long decreasing trend in the EU's GHG emissions means that they now represent 6.1% of global emissions, which is a sharp decrease from 14.9% in 1990[11].

9 World Weather Attribution. Deadly Mediterranean heatwave would not have occurred without human induced climate change. 31 July 2024. www.worldweatherattribution.org/deadly-mediterranean-heatwave-would-not-have-occurred-without-human-induced-climate-change
10 Crippa, M. et al., GHG emissions of all world countries, Publications Office of the European Union, Luxembourg, 2024. https://edgar.jrc.ec.europa.eu/report_2024
11 Including LULUCF it will be 5.6% in 2023 and 14.5% in 1990.

Figure 1.1: Global GHG emissions by main emitters (and rest of the world, RoW, 1990-2023) and annual changes[12] (2019-2023)

Figure 1.1.a

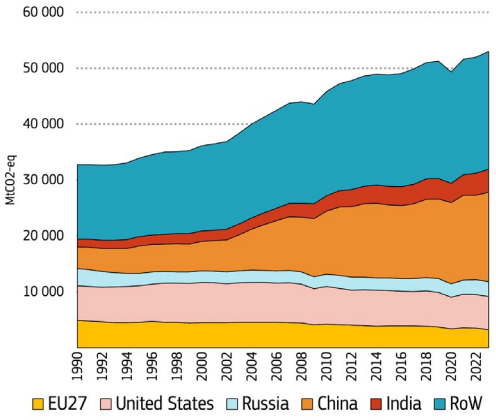
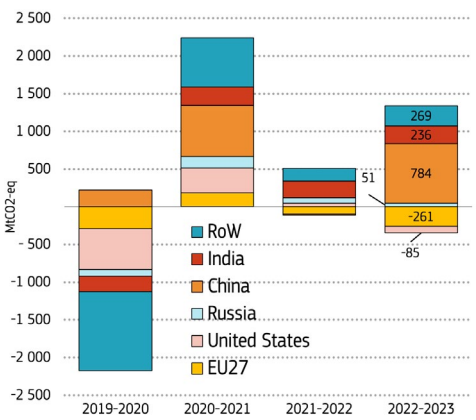


Figure 1.1.b



In the EU, provisional data[13] for 2023 show that total net GHG emissions, reflecting the EU target scope[14], decreased by 8.3% compared with 2022[15]. In the same year, economic activity in the EU broadly stagnated, with GDP growing by 0.5% in real terms. In absolute terms, the fall in GHG emissions in 2023 was the largest annual cut in several decades, excluding the COVID-19 pandemic year of 2020 (Figure 1.2.a). Consequently, in 2023 total net GHG emissions were 37% below their 1990 level, with GDP growing by 68% over the same period, showing the continued decoupling between emissions and economic growth[16].

Figure 1.2: EU GHG net emissions (EU target scope) and by sector[17]

Figure 1.2.a

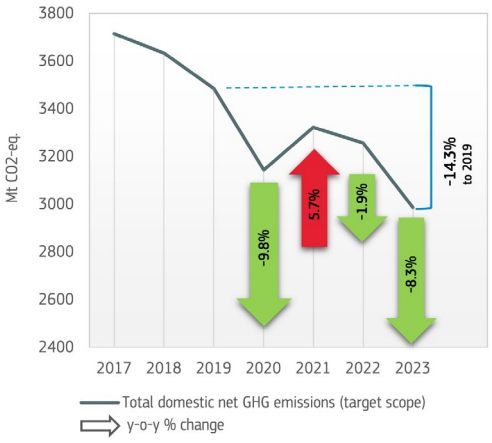
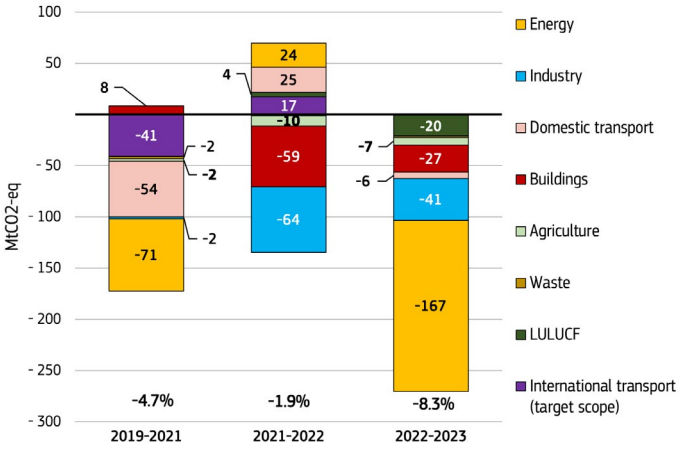


Figure 1.2.b



12 EDGAR (Emissions Database for Global Atmospheric Research) Community GHG Database (a collaboration between the European Commission, Joint Research Centre (JRC), the International Energy Agency (IEA), and comprising IEA-EDGAR CO_2, EDGAR CH4, EDGAR N2O, EDGAR F-GASES version EDGAR_2024_GHG, European Commission, 2024.

13 The Governance Regulation (Regulation (EU) 2018/1999) requires Member States to report approximated GHG inventories annually by 31 July. The EEA compiles an approximated EU GHG inventory based on that reported data or on the EEA's own estimates if a Member State has not communicated its approximated GHG emissions by that date. This provides an early estimate of GHG emissions ahead of the full GHG inventory.

14 The EU GHG emission aggregate, which better reflects the exact legal scope as provided by the European Climate Law, can be obtained by adding the EU-27 emissions from international aviation and maritime transport regulated under EU law to the EU-27's total domestic GHG emissions (including LULUCF net emissions or removals). For more details, see Chapter 2 of the accompanying staff working document.

15 GHG emissions and removals for 1990-2022 are based on the 2024 GHG inventories as submitted by EU Member States to the Commission by 15 March 2024. In 2024, however, the inventory reporting timeline has been exceptionally extended until the second half of the year due to the delivery of the UNFCCC Enhanced Transparency Framework (ETF) reporting tool. Member Staes will be able to submit an updated final GHG inventories to EEA by 15 September. The figures may therefore change following possible resubmissions resulting from later reviews. Together with the aggregated EU-level emission data, the GHG inventory will be submitted to the UNFCCC under Regulation (EU) No 525/2013 by the 15 December 2024.

16 The EU GDP growth rate (1990-2023) at constant price is based on our calculation using EUROSTAT (1995-2023, chain-linked volumes, 2015, National accounts) and by applying the World Bank real GDP growth rates (constant 2015 US$), back to 1990.

17 These values are based on 2024 GHG inventory and the approximated EU GHG inventory for 2023. These are based on Member States' submissions, with estimated values for international aviation and maritime emissions regulated in EU law (see Chapter 2 of the accompanying staff working document). Notes: (1) Energy sector refers to electricity and heat production and petroleum refining (1.A.1 GHG inventory code). It also includes indirect CO2 emissions, emissions from other sectors (1.A.5 GHG inventory code), and fugitive emissions (1.B GHG inventory code) (2) Industry includes fuel combustion in manufacturing and construction (1.A.2) and emissions in industrial processes and product use. (3) Buildings include emissions from energy use in residential and tertiary buildings, and energy use in agriculture and fishery sectors (1.A.4 GHG inventory code). (4) Negative values for the LULUCF sector indicate an increase of GHG removals.

The sectoral composition of the year-on-year emission changes (Figure 1.2.b) is still shaped by the dramatic events of the past four years. The emission reductions in 2021 were still the result of the COVID-19 lockdowns and restrictions, especially in sectors such as international and domestic transport emissions, which only recovered in 2022. Russia's full-scale invasion of Ukraine in 2022 prolonged and exacerbated the energy crisis that had already started in 2021, driving energy prices, particularly for natural gas, to record highs. The use of coal and lignite use in power generation, together with a lower level of nuclear and low hydro power production, was therefore greater in 2022 than in 2021 and this in turn boosted emissions in the energy sector. However, the reduced demand for both industrial and household energy in response to high energy prices more than compensated for the increase.

Emission reduction in 2023 is clearly linked to the acceleration of the energy transition, providing a solid basis for the future and increasing confidence that the EU can meet its climate targets, in a fair and competitive manner. The energy sector was the most significant driver of the record decrease in emissions, with emissions from the energy industry[18] decreasing by a remarkable 18% (167 $MtCO_2$-eq) compared with 2022. This drop was due to a substantial increase in renewable electricity production (primarily wind and solar), at the expense of both coal and gas and, to a lesser extent, a decrease in both electricity and heat supply (-3.1% and -2.3% respectively) compared with 2022[19], and to the recovery of hydro and nuclear power. Preliminary data for 2023[20] show that renewable energy sources were, for the first time by such a clear margin, the leading source for electricity generation (44.7% versus 32.5% from fossil fuel and 22.8% from nuclear power). The increase in renewable energy is primarily the result of the considerable amount of new solar and wind capacity installed in the last 2 years, with new records for the installation of solar PV[21].

Emissions in the industry sector[22] were also 6% down on 2022, especially for energy intensive industry (e.g. -8.4% and -7.8% in the mineral and metal industries, respectively). The emission reductions in industry are the result of a combination of reduced output and continued efficiency gains. The physical volume of EU industrial production fell by 2% in 2023 but is still higher than in 2019 and 2021[23]. However, above-average reductions were seen in the sectors that are most energy-intensive or use fossil fuels as feedstocks (e.g. pulp and paper, basic metals and chemicals). Efficiency gains in EU industry have been recorded over several years. These gains can be shown as the volume of emissions needed for one unit of production (e.g. emission intensity, GHG per unit of Gross Value Added). The most recent trend shows a steady decline in emission intensity for the energy-intensive industries (from 10% to 13% depending on the specific sector in 2017-2021).

Of relevance is the -5.6% (or 27 $MtCO_2$-eq) expected decline in emissions from buildings[24]. This was notably driven by a relatively milder winter[25]. The Energy Performance of Buildings Directive, which was adopted in April 2024, will inject additional momentum in decarbonising the EU building stock[26].

Emissions from domestic transport activities decreased only marginally in 2023 (-0.8%), despite a noticeable reduction in road freight transport (-3.2%, in terms of tonne/kilometres)[27] and the continued increase in the adoption of electric vehicles (48.5% year-on-year increase on 2022, up to a total number of 4.5 million electric vehicles)[28].

Overall, 2023 emissions covered by the EU Emissions Trading System (EU ETS) saw a record decrease of 15.6% compared with 2022 (where emissions reductions in the energy sector due to the uptake in renewable sources have most impact). In the Effort Sharing sectors, emissions also decreased, although less markedly, by 1.6%, compared with 2022.

Provisional 2023 data for GHG emissions and removals from the Land Use, Land-use Change and Forestry (LULUCF) sector show an increase in net carbon sinks of 8.5% (or 20 $MtCO_2$-eq) compared to 2022, although approximated emissions remain subject to large revisions.

In the EU, verified emissions from aircraft operators increased compared to 2022 by around 9.5% as the industry continued to rebound from the very low levels of activity during the COVID-19 pandemic.

18 Including fugitive emissions and indirect CO_2 emissions.
19 Eurostat (nrg_ind_pehcf) and (nrg_ind_pehnf). This refers only to heat that was sold – auto consumed heat is not reflected in these figures.
20 https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240627-1
21 In 2023, 55.9 GW of solar capacity and 16.2 GW of wind capacity was installed in the EU – on top of the 41.3 GW of solar capacity and 15.6 GW of wind capacity that had already been installed in 2022. This translates into a 36% cumulative increase of installed solar and wind capacity between 2021 and 2023, saving approximately 35 billion cubic meters (bcm) of gas over 2 years.
22 Industry includes fuel combustion in manufacturing and construction and emissions in industrial processes and product use.
23 This refers to the volume in the physical units – kilograms, square and cubic metres, numbers of items etc. Eurostat. Sold production, exports and imports (ds-056120).
24 Buildings include emissions from energy use in residential and tertiary buildings, and energy use in agriculture and fishery sectors.
25 As one of the most commonly used real-time indicator for progress in energy efficiency, the number of heat pumps sold in 2023 was similar to 2022 (around 3 million), according to the European Heat Pump Association (EHPA). If annual sales remain at this level, around 45 million heat pumps would be installed by 2030 – about 25% short of the EU's aims.
26 Directive (EU) 2024/1275. http://data.europa.eu/eli/dir/2024/1275/oj
27 Eurostat (road_go_tq_tott).
28 Eurostat (road_eqs_carpda).

1.2 Towards the climate-neutrality objective

Overall, provisional data for 2023 show that the EU's GHG net emissions are currently in line with the hypothetical linear reduction path to the EU's 2030 target of reducing GHG emissions by at least 55% compared with 1990 levels (see Figure 1.3.a). Going forward, an emission reduction of 134 $MtCO_2$-eq needs to be achieved every year from now until 2030, on average. This is a slightly larger reduction compared with the annual average cut of about 120 $MtCO_2$-eq seen over 2017-2023. This will require the full implementation of the legal framework for 2030 and the supporting investment flows. Beyond 2030, the pace of reductions must be at least maintained to allow the EU to reap the benefits of the transition. Efforts will have to focus increasingly on the 'harder-to-abate' sectors and on enhancing removals in the post-2040 period, to ensure the EU achieves its climate-neutrality objective by 2050 (see Figure 1.3.a).

EU Member States' GHG projections provide an indication of how EU GHG emissions are expected to develop. In 2024, 11 Member States updated their projections[29]. The aggregation at EU level of these national projections shows the same reduction level as analysed in the assessment of the draft NECP[30] (i.e., -51% for domestic GHG net emissions, when existing and additional measures are both considered)[31]. A preliminary analysis of the 14 final updated National Energy and Climate Plans (NECPs) submitted at the time of drafting this report points to a significant reduction of this identified gap to the EU's 2030 target of 55%.

At sectoral level, transport, buildings, and industry pose the greatest challenges to reducing emissions. Based on its modelling outcomes, the Commission expects sizeable emission reductions in those sectors in the next few years, but Member States' projections have so far shown little progress or have fallen significantly short of the required outcomes (Figure 1.3.b). The same sectors will also face significant decarbonisation challenges in the post-2030 period, but current Member States' projections fail to address these challenges. Agriculture seems likely to achieve the emissions cuts expected by 2030. However, the limited reduction of emissions in recent years and the efforts needed in the next decade merit additional analysis and better measurement of the impact of policies and measures. It may call for targeted initiatives in the agri-food value chain, including outside the farm gate, providing further incentives for emission reductions[32].

Lastly, the LULUCF carbon sink has been decreasing over the period 2014-2022, although it is estimated to have increased in 2023 compared with 2022, back to 2018 level. It is very important to ensure that this carbon sink can be enhanced and contribute to meeting our EU climate targets. Member States' projections are still falling short of the EU land-based net-removal 2030 target of an additional -42 million tonnes of CO_2 equivalent ($MtCO_2$-eq)[33] by around 45-60 $MtCO_2$-eq.

Figure 1.3: EU GHG net emissions, projections and targets. Past and expected emission reductions by sectors[34]

Figure 1.3.a

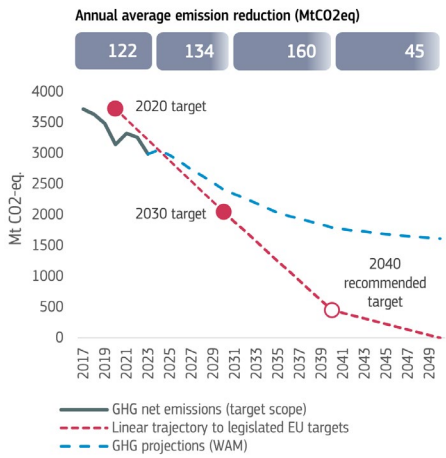
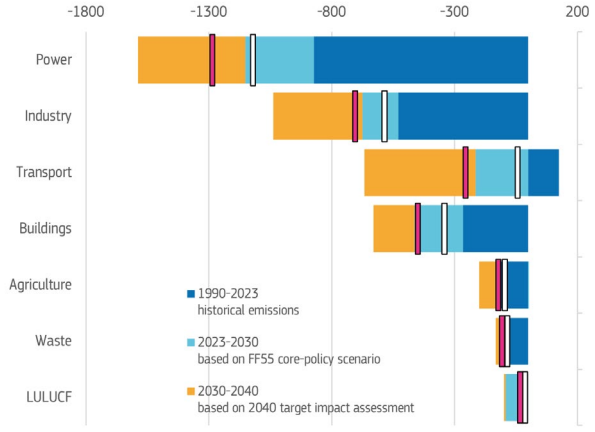


Figure 1.3.b



29 Member States submitted their emission projections by March 2023. In 2024, being a noncompulsory reporting year, only BE, DK, DE, EE, IE, IT, LV, LT, LU, AT and SE submitted updated reports in 2024 due to substantial changes. The EEA gap-filled missing 'projections with additional measures' with 'projections with existing measures'.
30 COM/2023/796 final.
31 This translates into a reduction of GHG emissions of 49% compared to 1990 when international maritime and aviation emissions regulated under EU Law, reflecting the EU target scope, are included.
32 See, for example, the Communication on the EU's climate target for 2040, p. 21.
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52024DC0063
33 As compared to the yearly average of net removals over the period 2016-2018.
34 Expected emission reductions at sectoral level are based on the modelling outcomes of the core policy scenario supporting the Fit-for-55 initiatives and on the impact assessment analysis accompanying the 2040 target Communication. For data and sectoral aggregation, please refer to footnote 19.

As required under the European Climate Law, the Commission assessed for the first time in its 2023 Climate Action Progress Report[35] the collective progress made by the Member States in achieving the EU climate-neutrality objective and the consistency of national measures with that objective. It concluded that although EU GHG emissions continue to fall and there are encouraging signs of action on the ground, it is still necessary to intensify implementation efforts and significantly accelerate emissions reduction to stay on track to reach climate neutrality by 2050.

In December 2023, and based on its assessment under the Climate Law[36], the Commission issued specific recommendations on climate neutrality to ten Member States[37]. It urged to step up their climate mitigation efforts, by making tangible progress on the existing and planned policies and to consider additional, urgent measures to align the expected GHG emission reductions and projections with the climate-neutrality objective. Where relevant, the Commission also called for Member States to update and increase the ambition and quality of their national long-term strategy.

All the concerned Member States, with the exemption of Poland, have notified the Commission on how they intend to address the recommendations (see, for more details, Section 3.3 of the accompanying staff working document). In a year's time, the Commission will reassess the situation based on the information included in the 2025 NECP progress report.

Chapter 3 of the accompanying staff working document, provides an update of the assessment of progress towards the EU climate-neutrality objective, including an update of the Climate-Neutrality Dashboard, with additional indicators going beyond the headline GHG emission data (i.e. Share of renewable, Zero-Emission energy, Greening industry, Sustainable mobility, Waste prevention, Climate mitigation investment, Sustainable consumption). Overall, the climate-neutrality dashboard highlights that, compared to last year's report, around two third of the indicators have improved, mainly due to the strong reduction in GHG net emissions in 2023. Among the seven complementary indicators, the 'sustainable mobility' and the 'zero emissions energy' levers have improved in almost all Member States, but changes in 'sustainable consumption' have been mixed. Among the Member States that in 2023 received specific recommendations under the European Climate Law due to their insufficient progress towards the EU's climate-neutrality objective, the dashboard highlights progress for Estonia, Italy, Latvia and Austria.

1.3 Progress on climate action in the EU

The co-legislators have now adopted all the proposals in the Fit-for-55 package, except the Revision of the Energy Taxation Directive[38], so that EU policies are now aligned with the updated 2030 target set in the European Climate Law (Regulation (EU) 2021/1119). The focus is currently on their implementation, which will enable the EU and its Member States to reduce by 2030 net GHG emissions by at least 55% compared with 1990 levels[39], and to make steady progress on adaptation to climate change (See Chapter 5).

The Commission has adopted secondary legislation to implement the strengthened EU ETS (which includes the maritime sector and the revised provisions for aviation), the new ETS for buildings, road transport, and small industry (Regulation (EU) 2023/957, Directive (EU) 2023/958, Directive (EU) 2023/959), and the Social Climate Fund (Regulation (EU) 2023/955). It has also adopted rules to implement the revised Effort Sharing Regulation (Regulation (EU) 2023/857), the revised LULUCF Regulation (Regulation (EU) 2023/839) and the revised regulation strengthening CO_2 emissions standards for new cars and vans (Regulation (EU) 2023/851).

The regulations that revise the rules on fluorinated gases and ozone-depleting substances, which will eliminate an additional 500 $MtCO_2$-eq of emissions by 2050, were also adopted by co-legislators and entered into force in March 2024.

The Commission has adopted around 39 delegated and implementing acts related to climate initiatives. The Member States have also started to implement the Fit-for-55 package, by integrating at national level the updated climate and energy targets as reflected in their NECPs (see below).

The co-legislators have adopted a number of other acts that will help to reach the climate targets: the regulation strengthening CO_2 emissions standards for new heavy-duty vehicles setting new ambitious CO_2 emissions reduction targets for 2030, 2035 and 2040 and the regulation on the EU-wide certification scheme for carbon removals, which sets out rules for the independent verification of carbon removals, as well as rules for the recognition of certification schemes that can be used to demonstrate compliance with the EU framework. In June 2024, the co-legislators adopted the Nature Restoration Law to restore ecosystems, habitats and species across the EU's land and sea areas to: (i) enable the long-term and sustained recovery of biodiverse and resilient nature; (ii) to contribute to achieving the EU's climate mitigation, and (iii) climate adaptation objectives and to meet international commitments.

35 Report from the Commission to the European Parliament and the Council of 24 October 2023, EU Climate Action Progress Report 2023, COM(2023) 653.
36 In accordance with Article 7(3) of the European Climate Law.
37 Czechia, Estonia, Ireland, Croatia, Italy, Cyprus, Latvia, Malta, Austria, and Poland.
38 This includes the revised EU ETS Directive, a new ETS for buildings, road transport and fuels, the Market Stability Reserve, the Effort Sharing Regulation, CO_2 standards for cars and vans, the Land Use, Land Use Change and Forestry Regulation, the Carbon Border Adjustment Mechanism, the establishment of the Social Climate Fund, FuelEU Maritime, the Alternative Fuel Infrastructure Regulation (AFIR), ReFuel EU Aviation, the Energy Efficiency Directive and the Renewable Energy Directive. Only the proposed revised energy taxation directive is still pending agreement.
39 The legislation as adopted is estimated to result in a net domestic reduction of GHG emissions of 57% by 2030 compared to 1990. An overview of targets is presented in Chapter 1 of the accompanying staff working document.

In February 2024, as required by the European Climate Law, the Commission published a Communication on the EU's climate target for 2040, which is an intermediate step on the path to climate neutrality in 2050. The Commission recommended reducing the EU's net greenhouse gas emissions by 90% by 2040 relative to 1990. Furthermore, in March 2024, the Commission published a Communication on Industrial Carbon Management which provides details on how technologies that can capture CO_2 or remove it directly from the atmosphere and then store or utilise it could contribute to this 2040 target and to reaching climate neutrality by 2050.

In March 2024, the Commission published a Communication on managing climate risks which sets out how the EU can effectively get ahead of growing climate-related risks and build greater resilience to the impact of climate change. The Communication is a response to the European Climate Risk Assessment and is part of the implementation of the 2021 EU Adaptation Strategy (see Chapter 5 for more details).

In 2023 the Commission proposed a regulation on a forest monitoring framework, which would set up a comprehensive and high-quality monitoring system covering all forests and other wooded land in the EU to better counter all pressures and hazards (see Chapter 4).

In September 2024, the Commission published a report on the functioning of the Regulation on the Governance of the Energy Union and Climate Action[40], along with an evaluation of the Regulation[41]. The Governance Regulation is a critical piece of legislation that sets common rules for planning, reporting and monitoring to ensure progress towards the EU's energy and climate targets. The evaluation concluded that the Regulation has achieved a significant part of its objectives by making planning and reporting more coherent, integrated, and streamlined, by helping to put the EU on track to meet its 2030 energy and climate goals. However, the evaluation identifies certain areas for improvement that could be considered in the event of a future revision of the Regulation, including the need to improve the future NECPs as true green transition investment plans, and enhancing the climate adaptation related provisions of the Regulation.

To strengthen the Commission's engagement with industry and social partners, President von der Leyen announced in the 2023 State of the Union a series of Clean Transition Dialogues. The Communication on the Clean Transition Dialogues published in April 2024 takes stock of these Dialogues and gives input for building blocks that can contribute to a reinforced industrial approach for a sustainable Europe.

The EU's Carbon Border Adjustment Mechanism (CBAM), which put a fair price on the carbon emitted during the production of carbon intensive goods that are entering the EU, will be implemented mirroring the phase out of free allocation in the EU ETS to prevent the risk of carbon leakage[42]. Since the start of the transitional phase of the CBAM, in October 2023, CBAM EU importers are subject to reporting obligations on a quarterly basis but without any financial obligations. In preparation for the definitive regime (1 January 2026), the Commission is developing the implementing and delegated acts as well as a review report (2025), necessary for the implementation of the measure.

By 30 June 2024, Member States were due to submit their final updated National Energy and Climate Plans (NECPs) in line with Article 14 of the Governance Regulation. The NECPs are 10-year strategic documents where Member States have the opportunity to set out policies and measures that will align their efforts with the EU's higher level of climate ambition under the European Green Deal. At the time of drafting this report, 14 Member States have submitted their final NECPs to the Commission[43]. As the draft NECPs fell short of achieving the climate target of at least -55% net GHG emissions by 2030 compared to 1990, the final NECPs need to demonstrate significant increase in efforts to reduce emissions. Member States also need to significantly step up their efforts on climate adaptation aspects of their NECPs.

1.4 Climate action for people

Climate Change and the green transition is affecting the entire economy and is leading to significant changes in our society, lifestyles, and job opportunities. The ongoing transformations affect skills, occupations, wages, working conditions and demand for labour. The number of workers moving from one sector to another is expected to increase as a result. The EU has taken action to support a successful skills transition. The European Skills Agenda aims at backing skill partnerships that address labour market needs, support green and digital transitions, and promote local and regional growth strategies. In 2022 and 2023, its flagship initiative Pact for Skills provided training to more than 3.5 million workers through 2 500 organisations[44]. According to a recent study[45], the installation of additional wind turbines and solar panels to deliver on the EU Green Deal targets would require about 130 000 to 145 000 additional skilled workers in the EU and associated investment in skills of EUR 1.1 to 1.4 billion by 2030[46].

40 COM(2024) 550 final
41 SWD(2024) 200 final
42 EU sectors covered by the CBAM (i.e. steel, aluminium, fertilisers, cement, electricity, hydrogen) will have to phase out their free allowances completely by 2034.
43 On 15 October 2024, the following Member States had submitted their final NECPs: Germany, Denmark, Finland, France, Ireland, Italy, Luxembourg, Latvia, Lithuania, Hungary, the Netherlands, Spain, Romania, Sweden.
44 https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1619
45 European Commission, *Estimating labour market transition costs and social investment needs of the green transition – a new approach*, Fair Transitions Working Papers, 2024. The results of the Working Paper have been developed under two joint projects between Directorate-General Employment, Social Affairs and Inclusion (DG EMPL) and the Joint Research Centre (JRC) of the European Commission. https://ec.europa.eu/social/main.jsp?langId=en&catId=1588
46 Job creation nonetheless differs across Member States, and those with relatively higher shares of renewable installed capacity today may present lower re-training costs per worker in 2030.

The EU has continued to inject resources to realise these opportunities. Almost 200 000 workers will gain new skills in projects financed by the Just Transition Fund. For example, between now and 2029 in Bulgaria, 3 000 unemployed people will be supported to get new green jobs, the inhabitants of more than 3 300 dwellings will benefit from improved energy performance, while 80 SMEs will be supported to invest in new skills for smart specialisation, industrial transition and entrepreneurship.

The sale of allowances in the EU Emission Trading System (ETS) continued to raise substantial revenues for Member States' budgets (see Chapter 2). For example, Greece reported to have allocated EUR 1.1 billion to its Greek Energy Transition Fund, supporting among others energy subsidies for low-income households, business support in transitioning areas, reskilling programmes and green infrastructure projects.

Under the ETS Modernisation Fund, disadvantaged carbon-dependent regions received support for a just transition in the energy sector, like in the case of Croatia where one scheme will support 80 MW of new renewable energy sources and 20 MW of energy storage capacity. This will lead to energy consumption savings of 140 000 Megawatt hours (MWh) per year which roughly equal to the electricity consumption of 31 thousand Croatian households.

Under the Recovery and Resilience Facility, Romanian households receive at least 122 000 vouchers to invest in the energy efficiency renovations of at least 33 000 homes and the installation of PV panels and storage batteries to produce renewable energy for their own consumption, as part of the REPowerEU chapter. One-stop-shops at regional level inform households about the benefits, practicalities, and funding opportunities for energy efficiency renovations[47]. And Slovakia will build more than 160 km of new cycling infrastructure by 2026 to support citizens to shift from individual road transport to cycling[48]. More than 9.8 million people across the EU are better protected against natural disasters thanks to the NextGenerationEU (see Chapter 6).

The EU Mission on Adaptation to Climate Change empowers European regions and local authorities to build resilience against climate change impacts. It aims to help at least 150 communities understand climate risks, develop pathways for preparation and implement innovative solutions by 2030 (see Chapter 5.4).

The transition can also bring benefits in terms of health and well-being. For example, lower energy consumption and a shift to non-emitting renewable energy sources and to less polluting combustion fuels improves air quality. The analysis of the 2040 climate target impact assessment estimates that achieving the 90% target could reduce premature deaths due to air pollution from 466 000 per year in 2015 to 196 000 per year in 2040.

Examples of funding of climate related projects

LIFE Climate Smart Chefs

The LIFE Climate Smart Chefs project has created the digital Foodprint tool to design climate-smart menus that empower the EU's chefs to become active challengers of climate change and promoters of low emission, nutritious and affordable diets. About 500 chefs in the EU have used Foodprint to reformulate recipes, so that they now use 34% less water than before and have reduced process CO_2 emissions by 49%.

LIFE Cool Square

The LIFE Cool Square project will undertake a significant greening of the Damsterplein of Groningen in the Netherlands. Turning it into a climate-adaptive, resilient and multifunctional urban location will mitigate heat island effects and reduce the negative health impacts associated with traffic. By the time the project concludes in 2026, it is expected to increase the use of Damsterplein by Groningen residents by 50% and to reduce traffic speed by 15% – leading to lower air pollutant levels (NOx and PM) and reduced noise emissions.

47 Recovery and resilience scoreboard. Thematic analysis Energy efficiency in buildings.
https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/assets/thematic_analysis/scoreboard_thematic_analysis_efficiency.pdf
48 Recovery and resilience scoreboard. Thematic analysis Sustainable Mobility.
https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/assets/thematic_analysis/scoreboard_thematic_analysis_sustainable_mobility.pdf

CHAPTER 2

The EU emissions trading system

Photo by Vladimir Boc, Romania

"Sustainable green spaces are a priority topic of the European Climate Pact. This small public space in Porto integrates most of the principles of sustainable landscaping, both in terms of vegetation and the materials used. In terms of vegetation, biodiversity and native species are promoted, ensuring a minimum level of maintenance, high energy efficiency and a reduced carbon footprint. The materials used are light in colour to reflect the sun during the summer and harmoniously integrate an old water channel that contributes to the sustainable management of rainwater."

Key highlights

- Emissions from installations in the EU ETS are around 47.6% below 2005 levels and well on track to meet the 2030 target of -62%. In 2023, emissions from power and industry installations have seen the highest annual decrease to date, of -16.5% compared to 2022, while verified emissions from aircraft operators increased by around 9.5%.
- The most important driver for the record decrease in EU ETS emissions has been the power sector, with emissions from electricity production in 2023 down by 24% compared to 2022. This decrease is due to a substantial increase in renewable electricity production (primarily wind and solar), and gas replacing coal.
- In 2023, the EU ETS raised EUR 43.6 billion in auction revenue for Member States' budgets, the Innovation Fund, the Modernisation Fund and the Resilience and Recovery Facility, which all support an effective and just green transition. Member States are now obliged to spend the entirety of their ETS revenue (or equivalent financial value) on climate action and energy transformation.

The EU Emissions Trading System (ETS) implements the polluter pays principle in the electricity and heat generation, industrial manufacturing, aviation and maritime transport sectors, which represent some 40% of EU's total emissions. It is a cornerstone of EU's climate action since 2005, with the system's scope having been expanded over time.

In the covered sectors, the EU ETS sets a cap on emissions, which decreases annually in line with the system's contribution to the EU's overarching climate target. The cap is expressed in allowances, which companies must surrender annually to cover their emissions. Companies primarily purchase allowances in auctions, which raise revenue for Member States to further support climate action and energy transformation. With the price of allowances determined by the market, the EU ETS incentivises emission reductions in a cost-effective and technology neutral way.

By 2023, the EU ETS had helped drive down emissions from the electricity and heat generation and industrial manufacturing by 47.6% compared to 2005 levels. This reduction has been achieved largely with a progressive decarbonisation of electricity and heat generation – a deployment of renewable energy sources and a gradual replacement of coal with gas use, as well as energy efficiency improvements. See ection 2.1 for further detail on emission trends in the EU ETS.

In parallel, the EU ETS has raised over EUR 200 billion in auction revenue that Member States have largely used to support projects in renewable energy sources, energy efficiency improvement and low-emission transport development. Since June 2023, Member States are required to use all revenue from the EU ETS (or a financial equivalent) to support climate action and energy transformation, including measures to address the associated social aspects. The obligation is among the changes agreed in the 2023 revision of the ETS Directive. See the upcoming Carbon Market Report 2024[49] for further detail about the revised EU ETS and the system's functioning in 2023.

49 At the time the current report is being finaliszed, the Carbon Market Report 2024 (Tthe report on the functioning of the EU ETS in 2023) is expected to be adopted in early November. Once adopted, the Carbon Market Report 2024 will be available on the website of the Directorate General Climate Action 'What is the EU ETS'.

2.1 Emission trends

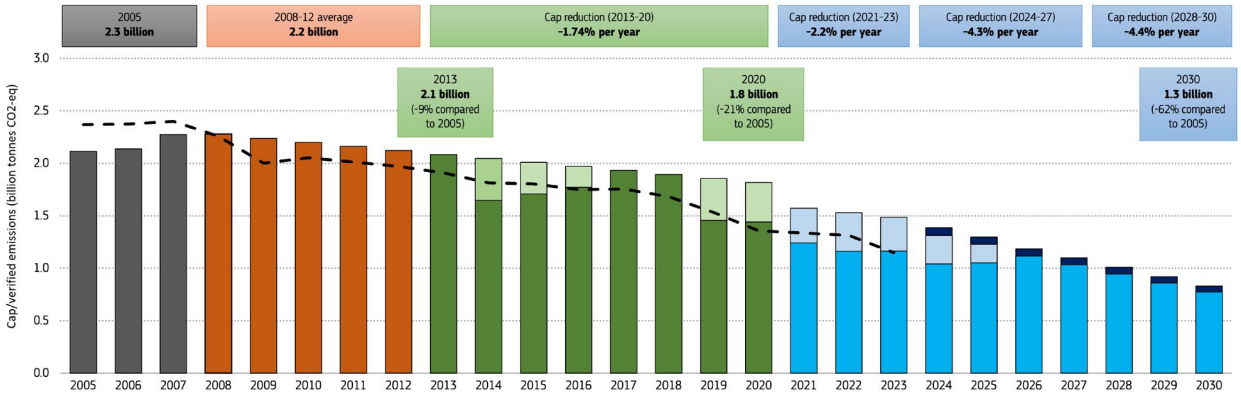
In 2023, total emissions under the EU ETS amounted to 1 149.1 $MtCO_2eq$ (down from 1 361.9 $MtCO_2eq$ in 2022). Emissions from power and industry installations accounted for 1 095.9 $MtCO_2eq$, 16.5% less than in 2022[50]. This is the highest reduction achieved to date.

The most important driver for the record decrease in EU ETS emissions has been the power sector, with emissions from electricity production having decreased by 24% compared to 2022. This decrease is due to a substantial increase in renewable electricity production (primarily wind and solar) and gas replacing coal. In 2023, renewable energy was the leading source of electricity in the EU, accounting for 44.7% of all electricity production[51]. At the same time, electricity generated from fossil fuels decreased by 19.7% compared with the 2022, contributing 32.5% of the total electricity production. With 16 GW capacity installed in 2023, wind surpassed natural gas to become the EU's second largest source of electricity behind nuclear[52].

In the energy-intensive industry sectors, a reduction of emissions of 7.5% compared to 2022 was observed, due to a combination of a reduced output and efficiency gains. Output levels for installations within the scope of EU ETS are not available at time of publication. However, industrial production statistics from Eurostat show that overall industrial production fell slightly in 2023 but remains higher than in 2019 and 2021 (i.e., immediately before the COVID-19 pandemic and Russia's invasion of Ukraine.

In aviation, year-to-year emissions have continued to increase after dipping substantially in 2020 due to the COVID-19 travel lock-down and economic downturn (see section 2.3 below). Emissions from maritime transport have only been included in the EU ETS since 1 January 2024 (see Section 2.3 below).

Figure 2.1: Emissions cap in the EU ETS compared with verified emissions (2005-2023)[53]



50 Emissions in this section refer to verified emissions within the scope of EU ETS, reported by Member States. This is different from the sectoral scope of other sections. For example, small thermal installations are typically excluded from EU ETS.
51 https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240627-1
52 State of the Energy Union Report 2024, COM(2024) 404 final, 11.9.2024.
53 Emissions cap in the EU ETS compared with verified emissions. The figure considers the 2023 revision of the ETS Directive, i.e. rebasing of the cap in 2024 and 2026, including the maritime transport sector in the EU ETS from 2024 and the linear reduction factor of 4.3% in 2024-2027 and 4.4% from 2028. Aviation is not included. Due to changes in scope, the 2005-2007 figures are not directly comparable with the latest ones. From 2021, the EU ETS no longer covers installations in the UK, only electricity generators in Northern Ireland. Legend: bars (cap), light shaded bars in 2014-2016 (allowances backloaded from auctions), light shaded bars from 2019 (feeds of allowances to the Market Stability Reserve), dark shaded bars from 2024 (maritime scope extension), dashed line (verified emissions)

2.2 Revenues raised by the EU ETS

The sale of allowances in the EU ETS auctions raises substantial revenues for Member States' budgets to support energy transformation and decarbonisation of ETS sectors. Overall, the ETS has raised over EUR 200 billion to date (EUR 113 billion in the 2021-2023 period). In 2023, the total ETS revenue amounted to EUR 43.6 billion. Of those, EUR 33 billion went directly to Member States. Of the remaining revenue, EUR 7.4 billion supplied the ETS Innovation Fund and the Modernisation Fund (See Chapter 6) and EUR 2.8 billion supplied the Resilience and Recovery Facility, which Member States use to advance the clean energy transition and boost energy security.

With the 2023 revision of the ETS Directive, the rules on the use of auction revenues have changed. Member States are obliged to use all ETS revenues for climate action and energy transformation (or an equivalent financial value), except for any revenue that Member States spend in aid for indirect carbon costs[54]. Under the Governance Regulation, Member States report annually to the Commission on how they spend their ETS revenue. Reporting for 2023 is analysed in Chapter 7 of the accompanying staff working document.

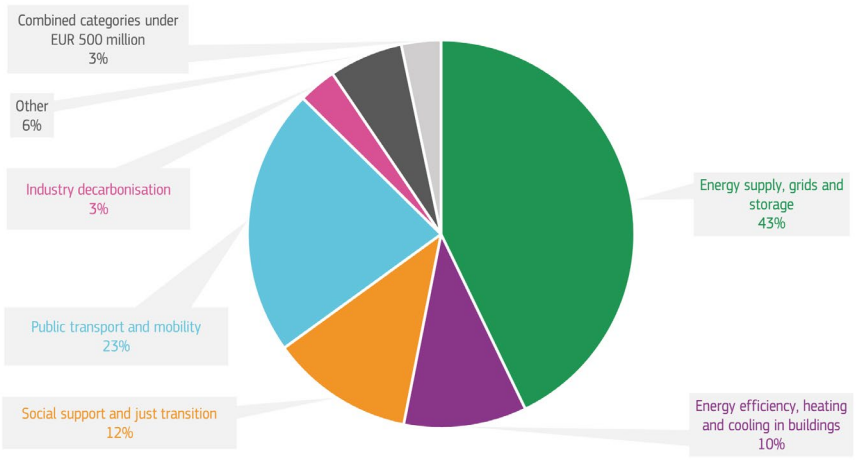
Overall, of the 2023 revenues subject to the obligation mentioned above, 72% was already disbursed and another 3% committed to a specific action. Future reports will account for how Member States will have used the remainder. Member States reported having disbursed EUR 22.7 billion to support projects in energy supply, grids and storage (EUR 9.7 billion), in energy efficiency, heating and cooling of buildings (EUR 2.3 billion) and in public transport and mobility (EUR 5.1 billion) (see Figure 2.2 for the 2023 disbursement of ETS revenue split in categories). Examples of projects include installation of photovoltaics systems in Romania, grants for energy efficiency improvements for low-income households in France, and expansion of the metro networks in Lisbon and Porto in Portugal.

In addition, Member States reported having allocated EUR 0.7 billion to projects in industry decarbonisation (low-carbon technologies, CCUS and energy efficiency in industrial sectors), including financial and technical support to business in the Walloon region of Belgium in their transition to a net-zero economy. Member States also reported having allocated EUR 2.7 billion to actions in social support and just transition.

For EUR 1.4 billion in 2023 disbursements, Member States reported the 'Other' category, which includes actions that do not fit any other categories or fit multiple categories. Examples include the Swedish Climate Leap fund that supports various emission reduction, biogas, biodiversity and research projects.

The EU ETS auction revenue has been an essential contribution to these and to many other impactful projects in the Member States. The case-studies of thirteen projects (co-) financed from auctioning revenues, accessible oin the European Environment Agency's website[55], showcase the positive effects that revenues have for the EU's climate transition. See Chapter 7 of the accompanying staff working document for more detailed data on the use of ETS revenue.

Figure 2.2: Use of the 2023 ETS revenue - split of the EUR 22.7 billion reported as disbursed per category.[56]



54 For more information see Carbon Market Report 2024 (as explained in footnote 51).
55 https://climate-energy.eea.europa.eu/topics/climate-finance/use-of-ets-auctioning-revenues/good_practices. Other good practices have been highlighted by the Life ETX project, which received funding from the European Union's LIFE Programme under grant agreement no.LIFE20 GIC/BE/001662 (see https://etxtra.org/lifeetx-national-human-stories)
56 The combined categories under EUR 500 million include (in EUR million): Road transport (309), Adaptation (155), International purposes and international climate finance (110), LULUCF, agriculture and land-based removals (59), Administrative expenses (54), Waste management (29), Maritime transport (17), Aviation (13), Permanent removals (3).

2.3 Action in aviation and maritime transport

Maritime

Maritime transport contributes to around 3-4% of total EU CO_2 emissions. In 2023, emissions from the sector, as collected under the Monitoring, Reporting and Verification Regulation[57], amounted to 126.7 million tonnes CO_2 when considering all emissions from voyages to and from EEA ports. Following the revision of the ETS Directive, the EU ETS started covering the EU's fair share (50%) of CO_2 emissions from large ships calling at EU ports as of 1 January 2024. For a smooth phase-in of the sector, for the year 2024 shipping companies will have to surrender allowances to cover 40% of the emissions reported under the EU ETS. This will increase to 70% for 2025 and to 100% from 2026 onwards. Non-CO_2 emissions (methane and nitrous oxide) are already being reported in 2024 under the Monitoring and Reporting Regulation and will be included within the EU ETS scope as of 2026.

At international level, the EU successfully supported the revision of the International Maritime Organisation greenhouse gas reduction strategy, agreed in July 2023, now setting the goal of net-zero emissions from ships by or around, i.e. close to, 2050, including through indicative checkpoints for 2030 and 2040. To deliver on these reduction targets, the EU is supporting the adoption, by 2025, of a basket of mid-term measures, to cover both a marine fuel standard and a maritime GHG emissions pricing mechanism, including through a Comprehensive Impact Assessment in 2024 to support the decision-making process.

Aviation

In 2023, ETS aviation emissions continued to rise to a total of 53.2 million tonnes CO_2. This is 9.5% higher than in 2022[58]. Throughout 2024 and 2025, the Commission is adopting implementing legislation[59] following the revision of the ETS Directive, to strengthen the EU ETS for aviation and increase the sector's contribution, and to implement the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) for extra-European flights of EU-based airlines. The EU is among the first jurisdictions worldwide to implement CORSIA in law. CORSIA has the purpose to offset aviation emissions from international flights above a certain level[60]. As of autumn 2024, this level has not been reached, and airlines have not had any offsetting obligations under CORSIA.

The overall climate impact of aviation is currently two to four times higher than the effect of its past CO_2 emissions alone[61], with non-CO_2 emissions accounting for 66% of the aviation's climate impact[62]. This analysis of the impact of non-CO_2 emissions is based on models. Both at European and international level, there are projects to measure non-CO_2 aviation emissions. There is no monitoring yet by Member States of non-CO_2 emissions from aviation. From 1 January 2025, the revised ETS Directive tasks aircraft operators to monitor and report the impacts of non-CO_2 emissions per flight annually[63]. By 31 December 2027, based on the results of the application of the monitoring framework of non-CO_2 aviation effects, the Commission will submit a report and, where appropriate, a legislative proposal to mitigate the non-CO_2 effects.

57 Regulation (EU) 2015/757.
58 Emissions figures for 2019 were a total of about 68,2 million tonnes CO_2, this included figures for the UK.
59 For example, as of mid-October 2024, the following have been adopted: the implementing regulation on the list of states other than EEA countries, Switzerland the United Kingdom considered to be applying CORSIA for emissions of the year 2023 was adopted in February 2024 (Commission Implementing Regulation (EU) 2024/622); the list of aircraft operators for 2024 adopted in March 2024 (Commission Implementing Regulation (EU) 2024/1030); the aviation cap for 2024 (updated version) adopted in June 2024 (Commission Decision (EU) 2024/1797); the detailed rules for the calculation of offsetting requirements under CORSIA published on 9 July 2024 (Commission Implementing Regulation (EU) 2024/1879).;
60 The level above which airlines should start to offset emissions is set as 85% of 2019 CO_2 emissions for the years 2024-2035 (where 2019 was the year with the highest ever aviation emissions).
61 Aviation and the Global Atmosphere, IPCC, 1999, https://www.ipcc.ch/site/assets/uploads/2018/03/av-en-1.pdf
62 Updated analysis of the non-CO_2 climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4), SWD(2020) 277 final.
63 The MRV system covers flights to, from and within Europe. To facilitate the start, reporting is mandatory for flights within Europe. This means in 2025 and 2026 voluntary reporting on all routes is encouraged. From 2027, the reporting obligation automatically applies to all flights. Consult the draft implementing legislation here: Emissions trading system (ETS) Monitoring and Reporting Regulation amendment in response to the ETS revision (europa.eu).

Example of funding of climate related projects

T-HYNET: Tarragona Network Hydrogen

The IF is backing the development of a cutting-edge 150-megawatt (MW) capacity alkaline electrolyser project in Spain's Tarragona industrial area. Thanks to the IF's EUR 62 million grant, T-HYNET will become Spain's largest electrolyser initiative, continuously producing 2.7 tonnes of renewable hydrogen per hour.

The electrolyser's state-of-the-art design features advanced alkaline technology, increased use of digital tools, and increased water-use efficiency by minimising water discharge and maximising water recovery. The renewable hydrogen that will be produced will be transported by a hydrogen pipeline to industrial off-takers and injected into the nearby natural gas network. The project's strategic location in Catalonia's Hydrogen Valley and the Ebro Hydrogen Corridor will facilitate hydrogen transmission to off-takers across the EU.T-HYNET is expected to create 900 direct and 1 100 indirect jobs, and to avoid emitting 1.4 million tonnes of CO_2 over a 10-year operational period. Aligning with the European hydrogen strategy and RePowerEU initiatives, construction is set to be completed by the end of 2026.

CHAPTER 3

Effort sharing emissions

Climate Shroomlutions
by Margarita Samsonova, Portugal

"A project that turns coffee waste into soils and grows mushrooms out of them for local restaurants is the most interesting and inspiring project that I have ever visited. The best part is that people can visit behind the scenes of facilities and get connected to mushrooms and circular economy. The world is connected in many different ways, but also through mycelium systems. That is why we should grow more, as these species can bring such interesting climate solutions!"

Key highlights

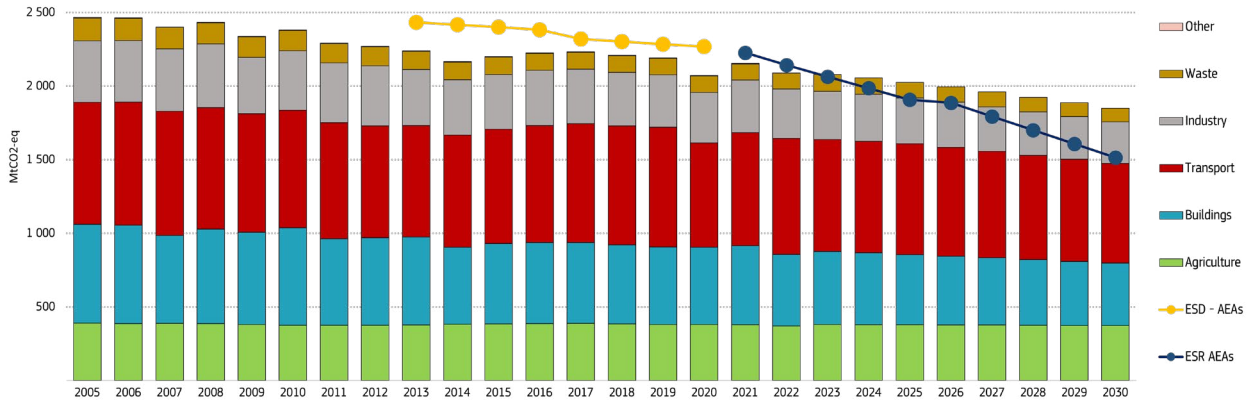
- In 2023, emissions from the effort sharing sectors continued to fall, down by 2% compared to 2022.
- These emission reductions were driven by the buildings sector, decreasing by around 5.5% in 2023 compared with 2022, followed by agricultural emissions which decreased by 2% in 2023 compared with 2022. Emissions from the transport sector, which accounts for over one third of total effort sharing emissions, reduced by less than 1% compared with 2022.
- All sectors have reduced non-CO_2 emissions between 2005 and 2022. The most significant reductions were in the non-ETS energy, small industry, and waste sectors.
- Aggregated projected ESR emissions are expected to fall by 37% in 2030 compared with 2005 levels, when planned additional measures are taken into account. This constitutes a 4-percentage points improvement compared to last year but falls short of the EU-wide ESR target for 2030 of a 40% reduction in emissions compared with 2005 levels.
- Despite the minor decrease in emissions from the existing stock of vehicles, the EU CO_2 emission standards for new cars and vans led in 2023 to the average CO2 emissions of new cars and vans further decreasing to 28% (cars) and 11% (vans) below 2019 levels, mainly due to a continued surge in the sales of new zero-emission vehicles. Average CO2 emissions of new heavy-duty vehicles also continued to fall. At the same time, the requirements under the fuel quality directive ensured that high-quality fuels were sold in the EU in 2023.

The Effort Sharing Regulation (ESR) covers GHG emissions from domestic transport (excluding CO_2 emissions from aviation), buildings, agriculture, small industry and waste[64]. They account for around 65% of the EU's domestic emissions. The ESR sets binding national targets to reduce emissions in those sectors compared to 2005 levels for the period 2021-2030.

Based on approximated data, emissions from the effort sharing sectors in 2023 were 2% lower than in 2022 or 19.2% lower than in 2005. The reduction in emissions resulted in particular from buildings, which decreased its emissions by 5.5% compared with 2022, followed by agriculture with a decrease of 2.0% compared with 2022. Emissions from the transport sector, which is the largest sector under the ESR and accounts for over one third of total effort sharing emissions, reduced by 0.8%.

64 Regulation (EU) 2018/842 of 30 May 2018, as amended by Regulation (EU) 2023/857 of 19 April 2023.

Figure 3.1: Emissions in sectors covered by effort sharing legislation 2005-2030 and annual emission allocations, EU-27



3.1 Progress in overall Effort Sharing emissions towards 2030

This section provides an indication of each Member State's progress in meeting its annual emissions allocations (particularly for 2022). This is based on the final GHG inventory data for 2022[65] and for 2021, the approximated GHG emissions for 2023 and the 2024 GHG projections for 2024-2030. The 2021-2025 compliance cycle is due in 2027 (following a comprehensive review of the 2021-2025 emissions) and the compliance cycle 2026-2030 is due in 2032 (following a comprehensive review of the 2026-2030 emissions).

The ESR, which was adopted in 2018 and amended in 2023, sets the EU-wide target to reduce emissions from the effort sharing sectors by 40% by 2030 compared with 2005 levels. The overall ESR target for the EU translates into national GHG emission reduction targets for 2030 and annual GHG emissions limits. Member States can also use flexibilities to comply with their annual emission limits and their 2030 targets. These flexibilities entail banking, borrowing, buying and selling, as well as accessing credits from the land use sector and for some Member States the possibility to access allowances from the EU ETS (for more details see Chapter 8 of the accompanying staff working document). Iceland and Norway also implement the ESR, but only the trends in (projected) emissions for the EU Member States are presented below.

In 2022, EU-wide emissions in the ESR sectors were 3.1% below the aggregated emissions limit, while emissions exceeded the annual emission allocations (AEAs) in eight Member States[66]. This was similar to the achievement in 2021[67]. The emission data for 2023 is still provisional; but it is expected that 10 Member States generated emissions that exceeded their AEAs[68]. The ESR emissions for 2021, 2022 and 2023 will be reviewed in 2027, when the compliance for each of the years 2021 to 2025 will be checked and determined. At that stage, Member States can use the flexibilities available under the ESR to comply with their annual emission limits. However, the emission projections that Member States submitted in March 2023 and March 2024 can already be used at this stage to gain insights into progress towards ESR targets.

By 30 June 2024, Member States were due to submit their final updated National Energy and Climate Plans (NECPs) in line with Article 14 of the Governance Regulation. Taking into account the 14 final NECPs that have been submitted to the Commission by the time of drafting this report[69] and the emission projections that Member States reported in March 2023 and March 2024, according to the most ambitious aggregated projections, emissions at EU level are expected to reduce by over 37% in 2030 compared with 2005 levels (see Figure 3.2). This is an improvement compared to the aggregated projections calculated based on draft updated NECPs, namely around 34% reduction of ESR emissions in 2030[70]. However, this still leaves a gap to the EU-wide ESR target of reducing emissions by 40% by 2030 compared with 2005 levels.

The Commission has also used Member States' latest emission projections, to assess their progress towards their annual emission limits in 2021-2030, taking into account the potential use of the flexibilities available under the ESR[71]. If Member States used saved AEAs from previous years (banking) or use AEAs from future years (borrowing) and/or the existing ETS flexibility and/or the LULUCF

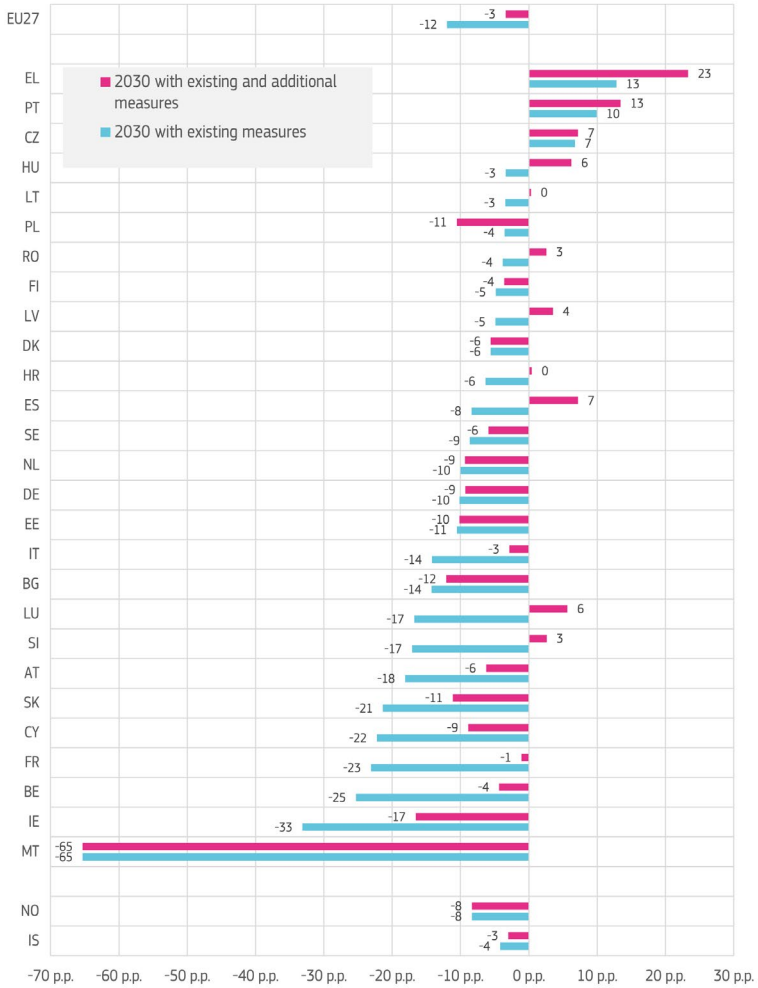
65 GHG emissions and removals for 1990-2022 are based on 2024 GHG inventory as submitted by EU Member States to the Commission by 15 March 2024. In 2024, however, the inventory reporting timeline is exceptionally extended until the second half of the year due to the delivery of the UNFCCC Enhanced Transparency Framework (ETS) reporting tool. Member Staes will be able to submit an updated final GHG inventories to EEA by 15 September. Therefore, figures may change following possible resubmissions resulting from later reviews. Together with the aggregated EU-level emission data, the GHG inventory will be submitted to the UNFCCC under Regulation (EU) No 525/2013 by the 15 December 2024.
66 Croatia, Cyprus, Hungary, Italy, Ireland, Latvia, Malta, Romania.
67 In 2021, EU-wide emissions in the ESR sectors remained 3.3% below the aggregated emissions limit.
68 Cyprus, Czechia, Denmark, Estonia, Ireland, Italy, Lithuania, Malta, Poland, Romania.
69 14 Member States (Germany, Denmark, Finland, France, Ireland, Italy, Luxembourg, Latvia, Lithuania, Hungary, the Netherlands, Spain, Romania, Sweden) have submitted their final updated NECPs to the Commission as of 15 October 2024.
70 COM(2023) 796.
71 Article 8 of the ESR provides that in case the Commission finds that there is not sufficient progress, Member States must prepare a corrective action plan. See table 8.2 in the accompanying staff working document for detailed data for each Member State.

flexibility 2021-2025 to cover excess ESR emissions, 11 Member States would still have excess emissions in at least one year in 2021-2030[72]. The fact that Cyprus, Croatia and Italy already had excess emissions in the first compliance period (2021-2025) increases the challenge because there is now less time available to develop additional policies to drive down emissions.[73]

Under Article 9(2) of the ESR, any net debit (i.e. excess emissions) under the LULUCF Regulation in 2021 - 2025 is automatically deducted from Member States' AEAs during the first ESR compliance period. Based on available estimated LULUCF emission data for 2021–2025, trends in Finland, France and Portugal give rise to concern (see Chapter 4). If these LULUCF trends are confirmed, those Member States may struggle to achieve their ESR targets each year in the first compliance period[74].

Under the ESR, nine Member States can use a limited amount of ETS allowances to offset emissions in the effort sharing sectors. The revision of the ESR allowed four of these Member States to increase their amounts of ETS flexibility[75]. Malta and Sweden have already notified the Commission that they intend to use this flexibility. Moreover, Member States that perform well under the LULUCF Regulation can use such overachievement, up to a limit, to cover any excess ESR emission. Member States can also transfer AEAs among themselves in order to match emissions with AEAs[76]. However, current projections suggest that, there may only be a limited amount of AEAs available for purchase.

Figure 3.2: Gap between ESR 2030 targets and projected GHG emissions (in percentage points)[77]



72 Bulgaria, Cyprus, Germany, Estonia, Croatia, Hungary, Ireland, Italy, Malta, Poland, Slovakia have excess emissions in at least one year in 2021-2030. Austria, Belgium, Denmark, Greece, Spain, Finland, Lithuania, Luxembourg, Latvia, Portugal, Sweden and Slovenia would have emissions below their AEAs each single year using banking and/or ETS flexibility. France and the Netherlands would expect a surplus of AEAs over the period 2021 to 2030 based on their final updated NECPs.

73 Available historical and approximated data is used for Member States' ESR emissions in 2021, 2022 and 2023 and projections for other years; Final ESR emissions will only be established following a comprehensive review in 2027 (for 2021-2025) and 2032 (for 2026-2030). The AEAs for 2026-2030 are estimated as they will only be set after a comprehensive review in 2025. For more details, see Chapter 8 of the accompanying staff working document.

74 For the purposes of this assessment, the excess emissions under LULUCF in the period 2021 – 2025 are equally distributed over the years 2021 to 2025 for calculating the reduction in AEAs under the ESR. Flexibilities under the LULUCF Regulation are not taken into account.

75 Belgium, the Netherlands, Sweden, and Malta. ETS flexibility allows a Member State to notify to the Commission an amount of EU ETS allowances to be available for ESR compliance. The EU ETS allowances are deducted from the amounts that would normally be auctioned under the EU ETS.

76 Iceland and Norway can also buy AEAs from and sell AEAs to Member States.

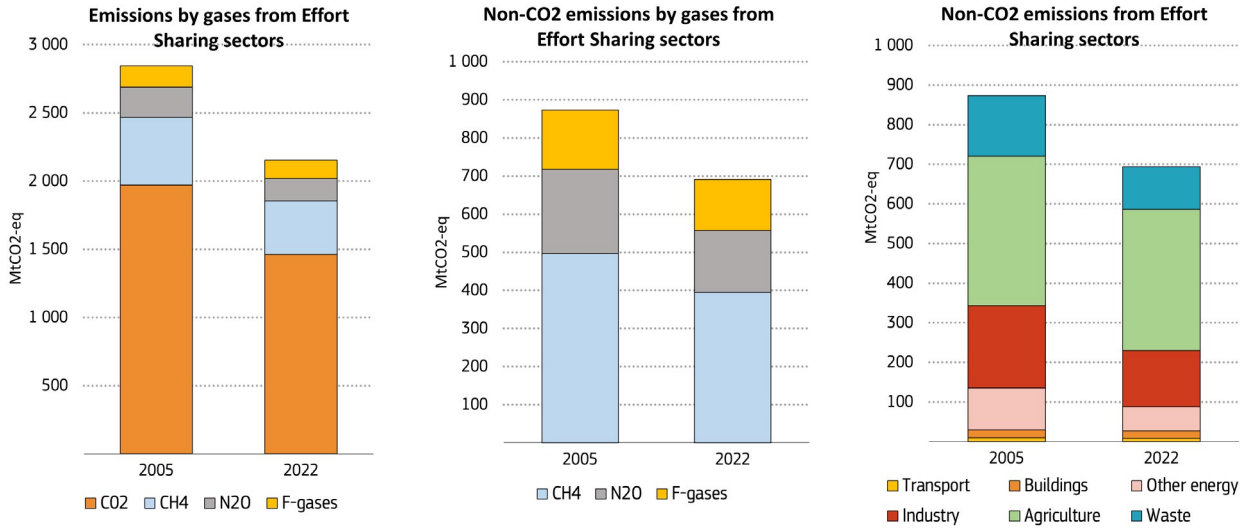
77 The graph is based on the latest emission projections that Member States submitted, including from March 2023, March 2024, draft updated NECPs or final NECPs.

Currently available information indicates that the EU's ESR emissions are still below the aggregated emissions limits in the years 2021, 2022 and 2023. The expected GHG emissions reduction in the ESR for 2030 has also been improving with the draft updated NECPs and based on currently available information, final updated NECPs appear to result in better than expected GHG emissions reduction for 2030. In December 2023, the Commission made recommendations to Member States based on their draft updated NECPs to step up action in the effort sharing sectors to reduce GHG emissions. At the time of drafting this report only 14 Member States had notified their final NECP. It is important to have assessed the complete information from the final updated NECPs before concluding whether or not a Member State is making sufficient progress. Based on the currently available information, six Member States would have to use the flexibilities available under the ESR and acquire additional AEAs in order to comply with their annual emission limits already in the period 2021 to 2025 period and eight others in the period 2026 to 2030[78]. As these Member States could be at risk of not making sufficient progress towards their obligations under the ESR, the Commission will already engage with them on their efforts to ensure compliance with the ESR obligations.

3.2 Emission trends by type of gas under the Effort Sharing legislation

More than two thirds of total emissions from the effort sharing sectors are CO_2 emissions, the remaining third are non-CO_2 emissions. Non-CO_2 greenhouse gases include methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (NF_3 , HFCs, PFCs, SF_6 , HFCs). While most of the emissions in the energy sector are covered by the EU ETS, methane emissions in this sector fall under the ESR. These non-CO_2 gases are emitted from a range of sectors and processes, and all have much higher global warming potentials than CO_2 by degrees of tens to tens of thousands depending on the gas. As a result, non-CO_2 emissions have an important impact on climate change and are key sources of potential emission reductions in several sectors. Mitigating non-CO_2 emissions can lessen global temperature increases rapidly. Reducing non-CO_2 emissions is also important to achieve our targets under the ESR. Around half of the non-CO_2 emissions come from the agriculture sector. All sectors have reduced non-CO_2 emissions from 2005 to 2022 but the most significant reductions were made in the non-ETS energy ('other energy'), small industry and the waste sector. Over the same period, non-CO_2 emissions from agriculture, transport and buildings have remained relatively stable. Most emission reductions were nitrous oxide emissions from non-ETS industry and the waste sector, and methane in the waste sector, while the level of F-gas emissions has remained relatively stable (Figure 3.3). The EU methane strategy aims to reduce methane emissions in the energy sector, as well as in the agriculture and waste sectors, and thus also supports the achievement of the ESR targets.

Figure 3.3: Non-CO_2 emissions under the ESR in 2005 and 2022, by sector and gas type



F-gases

Fluorinated greenhouse gases ('F-gases') have a global warming effect up to 24 000 times greater than CO_2. F-gas emissions in the EU amount to 2.5% of the EU's total GHG emissions. Hydrofluorocarbons (HFCs) are the most important F-gases. Thanks to the implementation of the 2014 F-gas Regulation (Regulation (EU) No 517/2014), there has been a consistent and significant reduction in F-gas emissions across the EU. Since this regulation entered into force in 2015, total F-gas emissions have declined by 27.6% after having doubled between 1990 and 2014. The biggest improvements were seen in the cooling industries, like refrigeration and air conditioning that have been shifting to more climate-friendly alternatives. The regulation was also successful in terms of

78 Croatia, Cyprus and Italy would be in such situation already in the period 2021-2025, and Finland, France and Portugal as well due to their LULUCF trends as explained above. Bulgaria, Germany, Estonia, Hungary, Ireland, Malta, Poland and Slovakia would be concerned for the period 2026-2030.

facilitating the global agreement reached in 2016 to phase down HFCs under the Montreal Protocol ("Kigali Amendment"), which is estimated to prevent up to 0.5 degrees Celsius of global warming by 2100. Since 11 March 2024, an even more ambitious F-gas Regulation (Regulation (EU) 2024/573) applies. Under the new rules, the amount of HFCs used must be reduced by around 95% in 2030 compared to 2015 and be phased out in 2050. These reduced F-gas emissions will continue to support Member States' efforts to reach their target under the Effort Sharing Regulation.

3.3 Road transport

Domestic transport emissions represent a quarter of the EU's overall GHG emissions and have decreased only slightly since 2005. Efforts to decarbonize the transport sector need to accelerate in order to meet the EU's 2030 and 2050 climate objectives. Inventory data indicated an average annual increase of 4 $MtCO_2$-eq between 1990 and 2022, a trend that is clearly not in line with meeting the EU 2030 domestic target[79]. The road transport sector is responsible for the great majority of transport emissions (around 95%, or 73% when international shipping and aviation are included), with more than 70% of road transport emissions originating from passenger cars and vans. Between 2005 and 2022, emissions from road transport decreased by only 4% and emissions from heavy-duty vehicles even increased by 1%. This shows that improved vehicle efficiency and the uptake of low-emission powertrains have hardly outweighed the effect of the continued increase in road transport activity.

The EU CO_2 emission standards for new cars and vans and for new heavy-duty vehicles are key policies for reducing road transport CO_2 emissions.

According to the provisional monitoring data for new **cars and vans** registered in the EU, Iceland, and Norway in 2023[80], the average CO_2 emissions[81] further decreased compared to 2022, from 108.1 gCO_2/km to 106.6 gCO_2/km for cars (-1.4%) and from 183.8 gCO2/km to 180.9 gCO_2/km (-1.5%) for vans. This is a continuation of the downward trend in CO_2 emissions observed since 2020, when stricter targets started applying. In 2023, average emissions were 28% (cars) and 11% (vans) below 2019 levels. This is mainly due to the surge in the share of zero-emission vehicle registrations. In 2023, 15.5% of new cars and 8% of new vans had no tailpipe emissions (up from 2.2% and 1.4% respectively in 2019). Progress has been therefore made in the past years, but significant further emission reductions are still needed to deliver on the future targets (Figure 3.4). By 2035, all new cars and vans should be zero-emission.

Figure 3.4: Average CO_2 emissions (dots) and EU fleet-wide targets (lines) for new cars and vans since 2020

Figure 3.4.a New cars

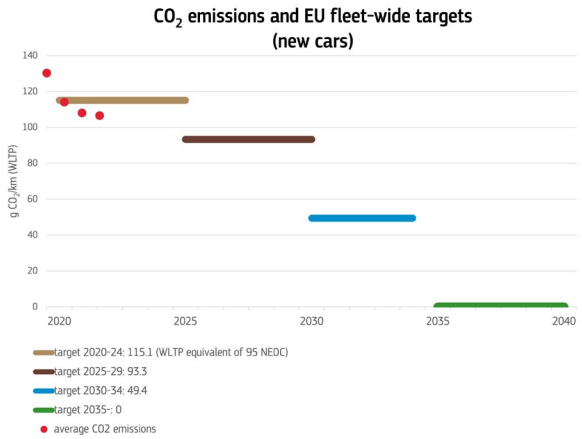
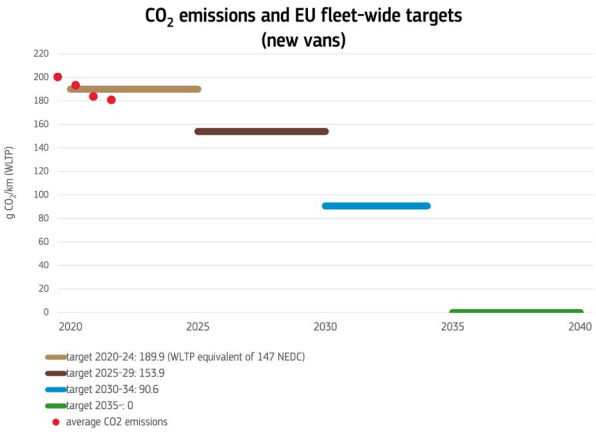


Figure 3.4.b New vans



Heavy-duty vehicles (HDVs), such as lorries, buses and coaches, generate 27% of all CO_2 emissions from road transport. The EU has recently adopted revised CO_2 standards for new HDVs to further tighten existing standards and extend the scope to smaller lorries, buses, coaches and trailers. Under the revised regime, CO_2 emissions must be reduced by 15% by from 2025 (unchanged by the revision), by 45% from 2030, by 65% from 2035 and by 90% from 2040 onwards compared with the 2019 baseline. There is also a new 90% zero-emission target for new city buses from 2030 and a 100% target from 2035 onwards. The provisional data of the reporting year from July 2022 to June 2023[82] show a fall in lorries' CO_2 emissions, a small increase in the number of new zero-emission lorries, and that about one quarter of new city buses are electric.

79 EEA greenhouse gases — data viewer — European Environment Agency (europa.eu)
80 Monitoring of CO2 emissions from passenger cars (europa.eu)
81 Determined during type-approval using the Worldwide Harmonised Light Vehicles Test Procedure (WLTP).
82 To be published soon.

The **Fuel Quality Directive** also contributes to reducing transport emissions by setting quality requirements for road transport fuels. Compliance with fuel quality limits is high in the EU. Almost all key fuel parameters in the samples taken in 2022 were reported to be within the tolerance limits (including the maximum sulphur content), and Member States reported the actions taken when non-compliant samples were identified. This confirms that the fuel quality monitoring system currently in place ensures that high-quality fuels are sold in the EU according to the requirements of the Fuel Quality Directive. Until 2023, Member States were also required to report on the 6% life cycle GHG emission intensity target for road transport fuels compared with 2010 levels, whereafter this decarbonisation target was taken over by the new Renewable Energy Directive. The average GHG intensity of fuels supplied in 2022 was 5.6% lower than in 2010. For more information on fuel quality, please see Chapter 5 of the accompanying staff working document.

Example of funding of climate related projects

Connecting Europe Facility (CEF)

In July 2024, the Commission announced grants of over EUR 7 billion to improve sustainable, safe and smart transport infrastructure throughout the EU. This funding, which is the largest under the current Connecting Europe Facility (CEF) transport programme, will support 134 projects aimed at expanding and modernising the Trans-European Transport Network (TEN-T). 80% of the total investment will go to rail projects, to strengthen cross-border connections along the EU's TEN-T core network. These include Rail Baltica, the Lyon-Turin connection between France and Italy and the Fehmarnbelt undersea tunnel linking Denmark and Germany.

Around 20 maritime ports in Germany, Ireland, Greece, Spain, Croatia, Cyprus, Lithuania, Malta, the Netherlands, Poland and Finland will receive support for infrastructure upgrades. Some will introduce sustainable practices such as the supply of shore-side electricity to ships and renewable energy transport.

The land use, land-use change, and forestry (LULUCF) sector plays a significant role in achieving the EU's climate neutrality goal. In the EU, the LULUCF sector absorbs more GHGs than it emits, removing significant volumes of carbon from the atmosphere. The sector also provides biomaterials that substitute fossil or carbon intensive materials, which is equally important in the transition to a climate-neutral economy. However, carbon removals have and continue to decline at a worrying speed in recent years.

This negative trend is, to a large degree, due to a decrease in forest-related removals, mainly as a consequence of an increase in harvesting, combined with a stabilisation or slight reduction in forest growth, especially in ageing forests in certain Member States. The annual net gain in living biomass is determined by photosynthesis minus harvest, mortality, and respiration. Climate change itself is having an increasing impact too. The growing frequency and severity of disturbances such as forest fires, wind throw, droughts, and insect and fungus outbreaks, is undermining the role of forests as a carbon sink and has in some cases turned them temporarily into carbon sources. There are many indications that, because of climate change, the future robustness of EU forest removals is far from guaranteed. At the EU level, cropland, grassland, wetlands, and settlements are the main sources of LULUCF emissions, with managed organic soils generating particularly high emissions[83].

83 On average, organic soils are reported to lose 7.9 tonnes of carbon per hectare per year (tC/ha/year).

CHAPTER 4

Land use, land use change & forestry

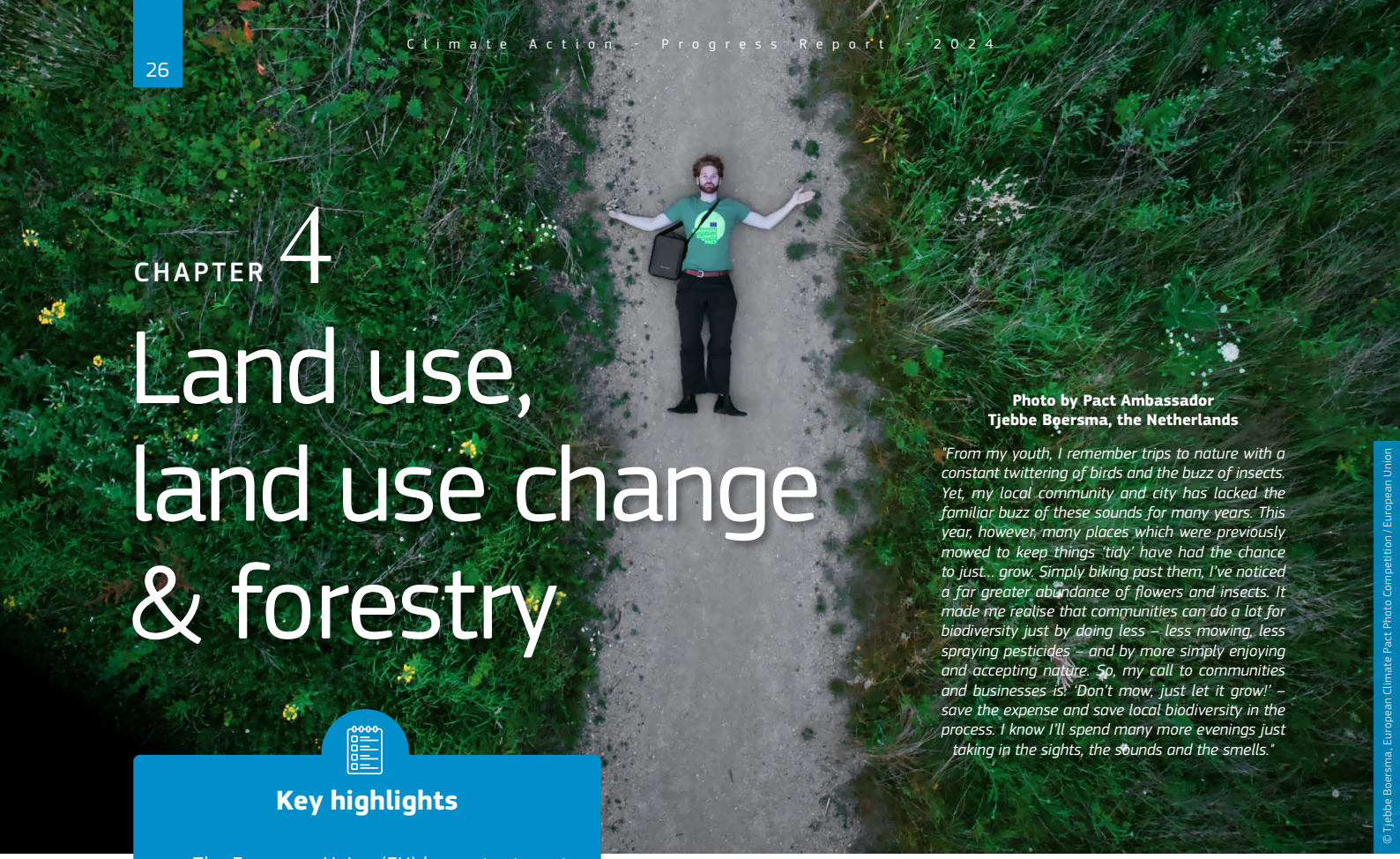


Photo by Pact Ambassador Tjebbe Boersma, the Netherlands

"From my youth, I remember trips to nature with a constant twittering of birds and the buzz of insects. Yet, my local community and city has lacked the familiar buzz of these sounds for many years. This year, however, many places which were previously mowed to keep things 'tidy' have had the chance to just... grow. Simply biking past them, I've noticed a far greater abundance of flowers and insects. It made me realise that communities can do a lot for biodiversity just by doing less – less mowing, less spraying pesticides – and by more simply enjoying and accepting nature. So, my call to communities and businesses is: 'Don't mow, just let it grow!' – save the expense and save local biodiversity in the process. I know I'll spend many more evenings just taking in the sights, the sounds and the smells."

Key highlights

- The European Union (EU) has set a target to increase land-based net removals of greenhouse gases by 2030. The goal is to remove an additional 42 million tonnes of CO_2 equivalent ($MtCO_2$-eq) from the atmosphere by 2030. It is very important to ensure that this carbon sink can be enhanced and contribute to meeting our EU climate targets.
- The LULUCF carbon sink has been decreasing over the period 2014-2022, although it is estimated to have increased in 2023 compared with 2022, back to 2018 level.
- The EU currently faces a gap of around 45-60 $MtCO_2$-eq to meet its 2030 target, according to Member States' projections. All Member States need to take additional action for the EU to reach its net removal target in 2030, and to help farmers and foresters develop sustainable business models.
- Improved land monitoring is crucial for effective climate action. More accurate and timely data will help the EU measure progress and make informed decisions and investments.

4.1 Assessment of progress in the LULUCF sector

A greater role for the LULUCF sector to support climate action.

The LULUCF target is to increase land-based net removals in the EU by an additional -42 million tonnes of CO_2 equivalent ($MtCO_2$-eq) by 2030[84]. This will result in total net removal at the EU level of -310 $MtCO_2$-eq[85].

For the period 2021-2025, specific accounting rules apply for different land accounting categories, which take into account specific historical benchmarks (such as the forest reference level). Member States are to comply with the 'no-debit' rule, meaning that 'accounted' emissions must not exceed 'accounted' removals.

For the period 2026-2030, reporting is simplified, with the accounting rules and corresponding benchmarks abolished. The additional -42 $MtCO_2$-eq target covers all LULUCF reporting categories and is distributed among Member States through individual targets, based on their share of total managed land area. The national 2030 targets require each Member State to increase its climate ambition and implement additional agriculture and forestry policies. (for more details, see Chapter 9 of the accompanying staff working document).

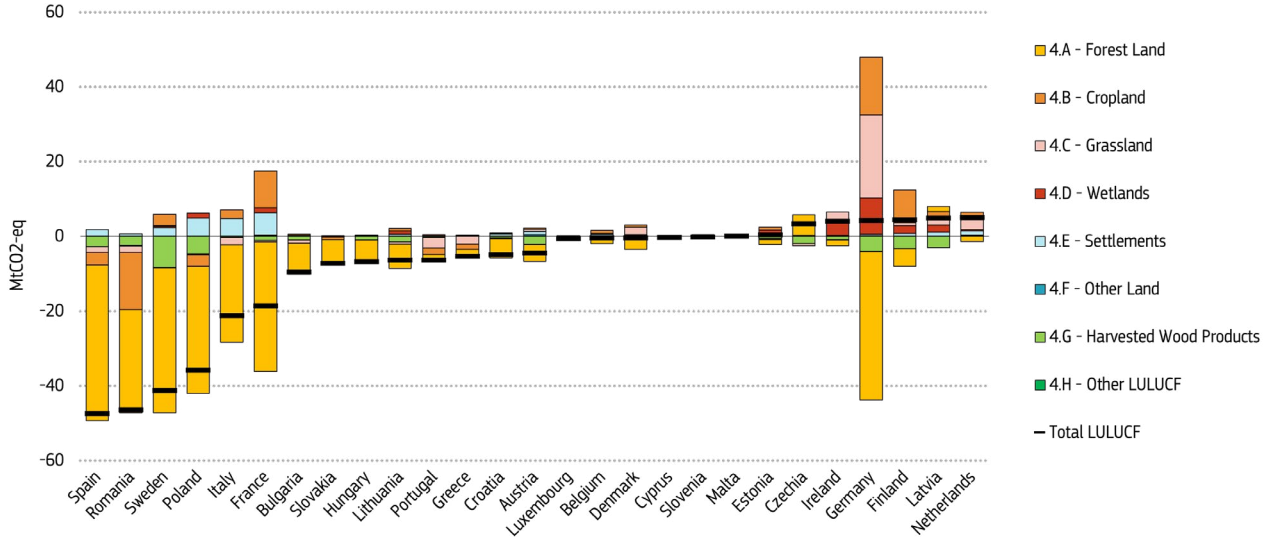
84 As compared to the yearly average of net removals over the reference period 2016-2018.
85 The average yearly net removals for the years 2016, 2017 and 2018, as reported in the 2020 greenhouse gas inventory submission, plus the additional -42 MtCO2-eq net removals result in total net removals of -310 $MtCO_2$-eq at the EU level. Any methodological adjustments in the inventory data reporting will be taken into account in the compliance check against the 2030 target.

Assessment of progress in the LULUCF sector

The negative trend of shrinking removals observed in recent years persists. While the EU appears to be on track to meet the 'no-debit' commitment in 2025, it is not on track to meet its 2030 target, with the level of net removals having dropped significantly as compared to the reference period of 2016-2018.

Based on the 2024 GHG inventory submissions, the provisional 'accounted' balance for 2021 and 2022 shows for the EU a total of accounted credits of -68 $MtCO_2$-eq, exceeding the 'no-debit' commitment for the first two years of the compliance period from 2021 to 2025. However, due to further methodological improvements of the greenhouse gas inventories expected in the future, these figures are subject to change in the next years. An update of the reference levels used for accounting is also foreseen at the end of the compliance period 2021-2025, to adjust them to these methodological improvements since 2020.

Figure 4.1: Land sector emissions and removals in 2022 based on MS reported data by main land use category.



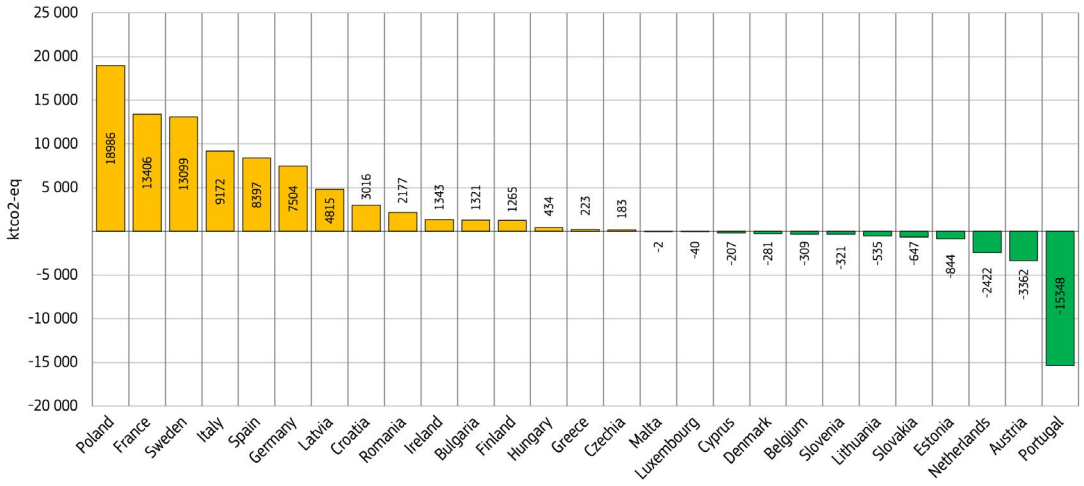
Based upon the data for two years of the compliance period (2021 and 2022), and excluding flexibilities available to Member States at the end of the compliance period, eight Member States showed accounting debits, meaning they might face challenges meeting the commitment in 2025, with France, Finland and Czechia showing the biggest debit[86]. In 19 Member States, the accounted removals are higher than accounted emissions, meaning they are in line with the 'no-debit' commitment, with Romania, Spain and Germany having the largest net credit in the EU[87]. As above, the figures are subject to change due to further methodological improvements of the greenhouse gas inventories expected in the future.

Looking further ahead to reaching the 2030 net removal targets, Member States need to reflect on the role of the land sector when updating their National Energy and Climate Plans (NECPs) for the 2021-2030 period. As part of this process, they should provide projections of the climate performance of their policies and measures up to 2030 and beyond.

86 Member States with debits in decreasing order of magnitude: France, Finland, Czechia, Portugal, Slovenia, Estonia, Belgium and Cyprus.
87 Member States with credits in decreasing order of magnitude: Romania, Spain, Germany, Denmark, Sweden, Hungary, Ireland, Austria, Italy, Lithuania, Poland, Bulgaria, Greece, Croatia, Slovakia, Netherlands, Latvia, Luxembourg and Malta.

Projections provided by Member States[88] show that the EU as a whole is not on track to meet its target of generating additional -42 $MtCO_2$-eq net removals by 2030, leaving a gap of around 45-60 $MtCO_2$-eq. In particular, Poland, France, Sweden, Italy, Spain and Germany project the biggest gap to their national 2030 targets, while Portugal, Austria, Netherlands and Hungary project to have the biggest surplus compared to the 2030 target (Figure 4.2).

Figure 4.2: Projected gap to the national 2030 targets, based on Member States' projections for 2030.



Most final updated NECPs do not set out sufficient ambition nor sufficient climate action related to the land sector. Very few Member States have proposed a clear pathway to reaching their national net removal targets for 2030. Moreover, at the time of drafting this report, only 14 of Member States have submitted their final plan. It is paramount that Member States swiftly design and implement adequate policies to put them firmly on track to reaching their climate targets. This should include measures to assist farmers, foresters and other stakeholders in building sustainable business models in line with these targets.

4.2 Action to step up land monitoring

The LULUCF Regulation requires that all Member States set up systems to monitor, inter alia, soil and biomass carbon stocks. Better data on land, soil and forests will help identify measures that unlock the highest climate benefits. The Commission's legislative proposal for soil monitoring, and for forest monitoring and resilience[89], as well as the revised LULUCF Regulation are mutually reinforcing. A resilient land sector, including soils and forests, sequesters and stores more carbon, while the LULUCF objectives promote the sustainable management of soils and forests.

Member States GHG inventories underpin climate action and are also continuously developing. Recalculations based on better data and improved methods can be seen in the inventories themselves. Further improvements are expected further in response to new needs for targeted and efficient policy making in both agriculture and forestry at the national level. Such improvements are in line with the requirements on high-quality and geographically explicit statistics in the revised LULUCF Regulation. Improved greenhouse gas inventories, based on harmonised and refined activity data and removal/emissions factors will be critical to facilitate action. Enhanced, more timely and mapped data will assist Member States and the EU identify optimal policy solutions, putting us on track to reaching our climate objectives.

Advanced technologies, such as those available under EU programmes, provide digital maps updated with high resolution satellite and ground observations. New steps are being undertaken to integrate information from the Copernicus Earth Observation satellite data, products, applications and services with other data such as those used for the Common Agricultural Policy (CAP).

88 The following sources of Member States' projections were used in the analysis in this report, based on the order of availability: final NECP submission (scenario with additional measures), final NECP submission (scenario with existing measures), projections reported biennially by Member States (scenario with additional measures), projections reported biennially by Member States (scenario with existing measures).
89 Proposal for a Regulation on a Forest Monitoring Framework ; Proposal for a Directive on Soil Monitoring and Resilience.

4.3 Related initiatives in agriculture and forestry

In addition to the Fit for 55-package, several other European Green Deal initiatives aim to increase the resilience of the LULUCF sector while protecting and promoting ecosystem services and the transition to a resource efficient circular economy and a sustainable bioeconomy.

The recently adopted EU framework for the certification of carbon removals[90] is designed to facilitate and speed up the deployment of high-quality carbon removals and emission reductions. It includes three distinct types of activities: carbon farming, carbon storage products, and permanent removals. The framework will not only provide land managers with new business opportunities, but also support growth of the sustainable circular bioeconomy by certifying carbon storage products, such as wood-based construction. Ultimately, this can assist Member States in attaining their LULUCF targets. To boost the industrial capture of carbon and its utilisation in bio-based products or storing it permanently.

Healthy ecosystems contribute to carbon sequestration and climate resilience and improve the wellbeing of populations. Activities such as the rewetting of peatlands can have a significantly positive impact on biodiversity. The Nature Restoration Regulation, a key element of the EU biodiversity strategy, calls for binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of climate change[91].

4.4 Incentives for removals and sustainable practices

Many funding mechanisms and incentives are available or being developed to encourage carbon removals, through public or private sector sources. The EU provides funding under the CAP, other EU programmes such as LIFE, Horizon Europe (in particular the Mission Soil), and the Cohesion Policy funds. In 2023, the Commission adopted guidance on EU funding opportunities for healthy soils[92]. Member States can also support the uptake of sustainable management practices under State aid rules, which have been revised and allow for the provision of forest ecosystem services such as climate regulation and biodiversity restoration. The Commission guidance on payment schemes for forest ecosystem services provides further information for actors. The CAP and State aid cover funding for investments and measures such as training, advice or cooperation, that help maximise effects. Private initiatives linked to voluntary carbon markets, or a combination of different funding options can supplement and further promote large-scale deployment of carbon farming.

The carbon removal certification framework will help ensure the transparent identification, through standardised methodologies, of carbon farming and industrial solutions that remove CO_2 from the atmosphere and store it long-term. Carbon removal certificates can also help organisations back credible carbon removal claims and meet stakeholders' expectations that carbon removals should not be used for greenwashing, in line with the Corporate Sustainability Reporting directive[93] and the proposed directive on green claims[94]. To facilitate future implementation the Commission has set up an Expert Group on carbon removals[95].

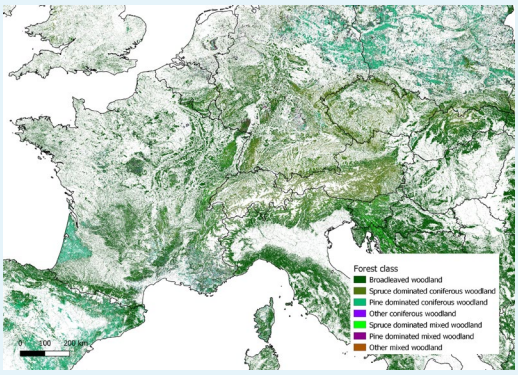
90 EUR-Lex - 52022PC0672 - EN - EUR-Lex (europa.eu)
91 Regulation (EU) 2024/1991
92 Commission Staff Working Document on the Guidance on EU funding opportunities for healthy soils
93 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022L2464
94 Proposal for a Directive on green claims - European Commission (europa.eu)
95 Register of Commission expert groups and other similar entities (europa.eu)

Examples of funding of climate related projects

LIFE PeatCarbon

LIFE PeatCarbon will help restore peatlands ecosystems in Latvia and Finland by demonstrating approaches to the climate-smart management of degraded peatlands and testing innovative methods for GHG monitoring. The project is expected to restore 5 076 and 338 hectares of peatland in Latvia and Finland respectively. This will save 37 117 tCO_2eq per year in Latvia and 3 500 tCO_2eq per year in Finland.

SWIFTT project: Climate change risks in Forestry



The SWIFTT project, financed by Horizon Europe, will provide a scientifically sound and technically feasible way to help monitor and manage forest risks: windthrow, insect outbreaks, and forest fires. SWIFTT will enable forest managers to adapt to climate change with affordable, simple and effective remote sensing tools backed up by powerful machine learning models. The solution will offer a monthly health monitoring service including early warnings, using Copernicus satellite imagery to detect and map the various risks to which forests and their managers are exposed. Early threat detection aids timely intervention. SWIFTT will be tested in real conditions by several end-users from the forest industry, which include Fürstliches Forstamt, Groupe Coopération Forestière and the Rigas Mezia. Once completed, SWIFTT's maps detailing areas of windthrow damage, insect outbreaks, and fire risk will enable forest managers to act proactively and allocate resources efficiently for a timely intervention. With SWIFTT's sustainable, effective, and low-cost forest management tools, Europe will be better positioned to combat climate change and preserve its biodiversity through healthier forests. The solution will help to monitor and protect up to 40 ml of ha of global forests by 2030, saving foresters over EUR 468 ml in monitoring costs.

CHAPTER 5

Preparedness for and resilience to climate change

Photo by Esmeralda Wirtz, Luxembourg

"I could have chosen a catchy picture of a zero-waste lifestyle, my life in a tiny house, the community compost I started, or of sustainable tourism. While my whole life revolves around climate action, I decided to leave out fancy environmentalism, and to show the reality of my community. In July 2021, my hometown got flooded, killing, destroying, and leaving 20% of its population without a home. Three years later, the consequences of this climate disaster can still be felt. Our community could only survive thanks to the climate actions of the many. Volunteers from all around the country made donations, cleaned houses, prepared food, gave admin support, provided shelters and even more. The climate crisis is a human rights crisis. Climate action has many faces, and not all are fancy."

Key highlights

- In 2023, Europe experienced its largest wildfires ever recorded, one of the wettest years, major marine heatwaves, widespread devastating flooding, and a continuing increase of temperatures.
- The first-ever European Climate Risk Assessment (EUCRA) of March 2024 assessed that 8 out of 36 major climate risks for Europe require urgent action today, and that all of the risks may become critical or even catastrophic in the future in the absence of adequate action. The EU and its Member States are not sufficiently prepared, nor keeping pace with the rapidly growing risks and impacts.
- The March 2024 Commission Communication on managing climate risks - protecting people and prosperity, sets out how the EU can effectively get ahead of the growing climate-related risks and build systematically greater resilience to climate change impacts, to tackle the serious risks faced head on.
- Risk exposure needs to be considered when setting overall policy priorities and deploying scarce resources at the national as well as the EU levels. This implies action across all sectoral policies, such as built environment, energy, health, water, food systems and the economy and finance. Nature-based solutions and ecosystem-based adaptation should be promoted.
- Adverse climate scenarios should be used to stress test instruments. While adaptive capacity is slowly improving in Member States, more needs to be done to promote whole-of-the-government approaches, including planning as well as cooperation between all layers of the government and with the private sector and citizens.

In 2023, Europe witnessed its largest wildfires ever recorded, one of the wettest years, major marine heatwaves, widespread devastating flooding, and a continuing increase of temperatures. The Commission's adaptation progress assessments of the end of 2023 show that the need for climate adaptation and preparedness is increasingly understood and its importance rising on the political agenda.

However, the EU's and the Member States' climate adaptation policies and measures are not keeping pace with the rapidly growing risks and impacts. The first-ever European Climate Risk Assessment (EUCRA) report of March 2024[96] identified 36 major climate risks for Europe. Eight of them require urgent action today, and without further action all of them will become critical or even catastrophic in the future. Bolder policies and more significant measures are urgently needed, and the Commission put forward proposals during the reporting year. This marks a turning point for the EU's climate adaptation action.

5.1 Context: EU adaptation policy

The European Climate Law requires the EU's institutions and the Member States to ensure continuous progress on adaptive capacity, strengthening resilience and reducing vulnerability, in line with the Paris Agreement. Implementation of the 2021 **EU Adaptation Strategy** is in full swing. Cohesion policy and other key budgetary programmes have embraced the 'do no significant harm' principle and prepared climate proofing practice to reduce the climate risk exposure of EU-funded investments. A range of sectoral policies are being updated for climate risks. The Member States are improving adaptation action.

The findings of recent Commission assessments are nevertheless mixed[97]. Steady progress has been made at EU level with implementing

96 European Climate Risk Assessment — European Environment Agency (europa.eu)
97 60a04592-cf1f-4e31-865b-2b5b51b9d09f_en (europa.eu), SWD(2023) 338 final, COM(2023) 796 final and 31 linked recommendation documents, SWD(2023) 932 final

the EU Adaptation Strategy, but the Member States need to do much more on governance aspects, awareness-raising, fair and just resilience, financing, and nature-based solutions, in line with the Commission recommendations on adaptation progress in individual Member States.

The European Court of Auditors (ECA) adopted a special report on EU climate adaptation in October 2024 in which it concluded that while the overall EU framework for adaptation policy was sound, there were weaknesses and gaps in its implementation[98]. Besides others, the ECA recommended to improve reporting on climate adaptation, better develop and promote EU tools for climate adaptation, and ensure that all relevant EU-funded projects are adapted to the current and future climate conditions.

The latest Commission assessments of the draft updated NECPs noted that the NECPs and the Member States' planned and implemented adaptation policies and measures were not synchronised. The Commission has issued recommendations to address this concern.

The first years of the implementation of the European Climate Law were analysed by the Commission in spring 2024[99]. Providing for continuous progress on adaptation, the European Climate Law together with the EU Adaptation Strategy have set the long-term direction of travel and increased investment predictability by providing for continuous progress on adaptation (See Chapter 1.3).

5.2 Further developing EU adaptation policy

The EEA published the first **EUCRA** report in March 2024 to help identify policy priorities for climate change adaptation and for climate sensitive sectors. This innovative assessment mobilised over 100 scientists across Europe and classified the 36 major climate risks for Europe in five clusters: food, health, ecosystems, infrastructure, and the economy and finance. Eight of these are urgent and more than half require more action now, primarily to conserve ecosystems, protect people from heat, protect people and infrastructure from floods and wildfires, and to secure the viability of EU solidarity mechanisms. The assessment shows that the EU's policies and adaptation measures are not keeping pace with the rapidly growing risks. Incremental adaptation will often not be sufficient and urgent action is likely to be needed even on risks that are not yet critical, because many measures which improve climate resilience take effect slowly over prolonged periods.

In response to the findings of the EUCRA report, the March 2024 Commission Communication on managing climate risks - protecting people and prosperity demonstrates the Commission's resolve to take the risks and concerns seriously and tackle them head-on. The policy document sets out how the EU can effectively get ahead of the growing climate-related risks and build systematically greater resilience to climate change impacts. It identifies measures to be implemented by stakeholders in order to meet their responsibilities (at the EU, national and subnational levels), and measures for both policymakers and the private sector. It underscores the point that action to improve climate resilience is essential for maintaining societal functions and protecting people, economic competitiveness and the health of the EU economies and companies. It identifies four horizontal areas where progress can systemically improve EU climate resilience:

- improved governance (in particular clarity on risk ownership implementation at national level);
- better tools for empowering risk owners (especially tools that provide clarity on climate data and scenarios);
- harnessing structural policies (spatial planning and the protection of critical infrastructure in the Member States); and
- setting the right preconditions for financing climate resilience.

The Communication is the start of a dialogue and of further work to promote societal preparedness, sound risk management, climate adaptation and resilience through legislative and non-legislative activities.

See also Section 7 for the UAE Framework for Global Climate Resilience and the UAE-Belém work programme on indicators, as important drivers for EU adaptation action.

98 https://www.eca.europa.eu/en/publications/SR-2024-15
99 COM(2024)196 final

5.3 Adaptation in EU sector policies

a. Ecosystems

Climate change is a key driver of biodiversity loss and ecosystem degradation in the EU. Of the five major climate risk clusters identified in the EUCRA report, the ecosystems cluster had most risks requiring urgent or more action. Climate impacts on land, freshwater and ocean ecosystems can cascade into food production and security, human and animal health, infrastructure, land use and the wider economy. Risks to marine and coastal ecosystems are particularly severe and require most urgent action.

In line with the findings of the International Panel on Climate Change[100] and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services[101], the Commission's Communication on managing climate risks states that, to maintain and restore the resilience of ecosystems and the services they provide, some 30 - 50% of the Earth's land, freshwater and oceans will need to be effectively and equitably preserved. In addition, in its climate adaptation progress assessments for the individual Member States the Commission recommended ensuring greater promotion of, and more investment in, nature-based solutions[102].

Recent key EU policy initiatives include legislative proposals on forest monitoring[103], forest reproductive material[104], and soil monitoring and resilience[105]. The EU's Nature Restoration Law came into force in August 2024[106]. Its legally binding obligations for nature restoration will help the EU climate adaptation objectives to be achieved. It requires Member States to develop national restoration plans that take climate scenarios into consideration and work in synergy with national adaptation strategies and plans.

b. Water

Water resources are under pressure in many parts of the EU. Climate change is exacerbating those pressures and increasing water-related risks in the form of more frequent and prolonged droughts or extreme precipitation. These are set to worsen in the future with more of the EU affected by water stress, a growing risk of mega-drought, wildfires, increasing floods, and rising sea levels that heighten the risk of coastal floods and storm surges, coastal erosion, and salt-water intrusion. Water stress and scarcity are challenges to the provision of critical resources, like food or energy.

The EUCRA report emphasised that water-related risks cut across all major sectors and that severe floods, droughts and wildfires are becoming a health threat and a recurrent cause of social, environmental, and economic losses.

In 2023 the European Drought Risk Atlas[107] was published. It provides a comprehensive assessment and mapping of present and future drought risks and impacts in the EU for different systems, such as agriculture, water supply, energy, river transport, and ecosystems.

In June 2024, the Water Directors of the Member States and the Commission working on the Common Implementation Strategy, adopted the updated Guidance on Water Management in a Changing Climate, to help water managers incorporate climate mitigation and adaptation in their activities.

c. Public health

The climate crisis is a major public health threat. It affects the health of individuals and the functioning of health systems. For instance, the summer heatwave of 2022 killed more than 60 000 people. Locally acquired tropical infectious diseases (e.g. dengue fever and West Nile virus) are on the rise. In Portugal, heat waves were shown to have caused a 19% increase in hospitalisations across all age groups and major disease diagnostic categories[108].

The EU not only supported the Budapest Declaration in 2023[109], but also joined the United Arab Emirates Declaration on Climate and Health[110] in December 2023, which breaks new ground in international policymaking on climate and health.

100 IPCC: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 2003.
101 Pörtner, H.O. et. al., Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change; IPBES secretariat, Bonn, Germany, 2021.
102 SWD(2023) 932 final
103 COM(2023) 728 final
104 COM(2023) 415 final
105 COM(2023) 416 final
106 www.consilium.europa.eu/en/press/press-releases/2024/06/17/nature-restoration-law-council-gives-final-green-light
107 https://publications.jrc.ec.europa.eu/repository/handle/JRC135215
108 www.thelancet.com/journals/lanplh/article/PIIS2542-5196(24)00046-9/fulltext
109 www.who.int/europe/publications/i/item/EURO-Budapest2023-6
110 www.cop28.com/en/cop28-uae-declaration-on-climate-and-health

At EU level, the Commission is working to protect people and health systems against the growing effects and risks of climate change by, for instance:

- boosting the remit and resources of the European Climate and Health Observatory[111];
- enhancing surveillance and medical countermeasures against climate-sensitive infectious diseases;
- publishing a Communication on a comprehensive approach to mental health[112]; and
- planning the publication in early 2025 of a new strategic research and innovation agenda on climate and health.

d. Agriculture and food

The agricultural sector is one of the sectors most vulnerable to climate change. It is endangered by a lack of precipitation leading to droughts, by too much precipitation resulting in erosion, landslides and floods, and by hail and frost. The food sector and the whole food value chain are vulnerable. Future climatic conditions need to be considered in sectors such as agroforestry.

The new 2023 EU CAP has three main objectives (climate change, environment and landscapes), reinforced conditionality (good agricultural environmental conditions), eco-schemes (e.g. organic farming or carbon farming), and other instruments to increase the use of measures related, inter alia, to climate change adaptation. All Member States have recognised the need to address climate adaptation and have programmed support based on their needs assessment[113]. Their uptake nevertheless depends on how Member States prioritise them in their CAP strategic plans.

The Strategic Dialogue on the Future of EU Agriculture[114] recognises that a fundamental step to make the European agrifood sector more resilient consists in proactively preventing and reducing risks, in particular those arising from climate change and environmental degradation. The report touches upon topics under the theme of adaptation, specifically water resilience in agriculture and innovative plant breeding approaches. As explained in Section 4 , it also recommends that the European Commission and the Members States work on a coherent mix of policies combining incentives and regulatory measures., including rewarding and incentivizing farmers to establish and to continue providing ecosystem services. In light of growing environmental, climate, geopolitical and economic risks, the report recommends strengthening risk management tools and crisis management. Along with the other elements of the report, this will be further looked at in the Vision for Agriculture and Food planned for early 2025.

e. Infrastructure and the built environment

Climate change poses significant risks to infrastructure and the built environment, including threats to cultural heritage[115]. Assets need to be designed today to withstand the climate and weather of tomorrow. Risks are manageable if they are properly addressed, and it is essential to work on several aspects in parallel. Spatial planning for land and water needs to include resilience considerations for infrastructure and the built environment. Further efforts to green the infrastructure will help, because green elements (e.g. green roofs, rain gardens and permeable pavements) can help to manage storm waters and reduce the impact of floods.

At EU level, the Commission is progressing with the climate proofing of the European standards that are most relevant to infrastructure. International and European standards provide guidance on the design of infrastructure and buildings. Having standards that require future climatic conditions to be taken into consideration is a powerful lever. In December 2023 the Commission presented a draft standardisation request to integrate climate change into infrastructure and buildings standards, which is expected to be adopted by the end of 2024.

The exposure of infrastructure and the built environment needs to be considered when planning for and implementing the energy transition. The EUCRA report highlights the risk of energy disruptions, due to climate hazards such as heat and drought, especially in Southern Europe. Even so, limited progress has been made at EU level on the resilience of energy systems. The Commission has in its assessments of the draft updated NECPs recommended that Member States need to better plan for resilient energy systems and promote the mainstreaming of adaptation. Significant further work remains.

f. The economy

Each climate change-related disaster puts a strain on the economy, due to loss of life and productivity, direct damage, reduced growth potential and greater pressure on public budgets. Redirecting investment towards rebuilding after damage reduces the funds available for productive investments. Climate risks can push existing vulnerabilities in the financial systems over critical thresholds. Government budgets are the main source of coverage for risks, but they are strained.

111 https://climate-adapt.eea.europa.eu/en/observatory
112 https://health.ec.europa.eu/publications/comprehensive-approach-mental-health_en
113 Report from the Commission to the European Parliament and the Council, Summary of CAP Strategic Plans for 2023-2027: joint effort and collective ambition. COM(2023)707 final
114 https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/main-initiatives-strategic-dialogue-future-eu-agriculture_en
115 Strengthening cultural heritage resilience for climate change - Publications Office of the EU (europa.eu))

The insurance coverage of climate exposed assets and property is low in the EU and varies significantly between Member States and different climate hazards. This coverage is expected to shrink even further due to increases in premiums as climate-related events occur more often. The Climate Resilience Dialogue brought together insurers, businesses, consumers, and other stakeholders to exchange views on how to address the low proportion of insured losses incurred because of climate disasters. It published its final report in July 2024[116].

The Commission has announced the establishment of the temporary Reflection Group on mobilising Climate Resilience Financing to address the climate resilience investment gap and help facilitate climate resilience financing by sharing knowledge and tools, mapping best practices and identifying obstacles and enabling conditions for EU climate resilience financing. The Group will conclude its work in December 2025.

5.4 The EU Mission on Adaptation to Climate Change

The EU Mission on Adaptation to Climate Change supports European regions, cities and local authorities in building resilience against climate change impacts. It is fully operational and has a continuously expanding portfolio of supporting and enabling tools.

Currently, 311 signatory regions and local authorities have committed to working within the Mission framework. Local and regional decision-makers in Europe are supported with knowledge and tools brought to them through the Mission Portal.

The Mission Implementation Platform provides support and technical assistance to local actors in their resilience building efforts and facilitates exchanges of best practices between those involved in climate adaptation.

Thanks to the Mission's support, about 100 regions and local authorities are receiving technical support to develop plans to address their local climate vulnerabilities and to secure funding for the measures identified. In addition, more than 40 Mission-funded projects, that carry out research and develop innovative climate adaptation and resilience approaches, are underway with the direct involvement of regional and local actors. They go beyond theory by delivering practical and tangible outcomes through guidance, tailor-made tools, context-specific data, on-the-ground testing, and piloting the most promising solutions identified in the Mission case studies (See separate Staff Working Document for more information).

116 Climate Resilience Dialogue - European Commission (europa.eu)

Examples of funding of climate related projects

Mission Regions4Climate

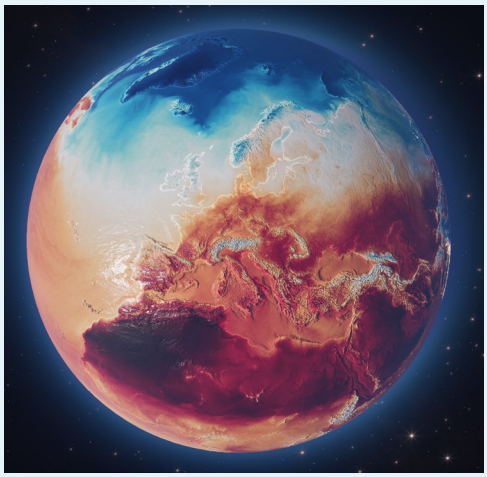
The Burgas region in Bulgaria faces a series of climate-related challenges (including flooding and urban heat and air pollution) due to rising temperatures and the characteristics of its terrain and wetlands. These are compounded by urban density and limited green space.

To combat these climate challenges, the region adhered to the Mission Adaptation Charter and is part of the Mission Regions4Climate project. Thanks to the supported Smart Adaptation Challenge Suite (an innovative digital tool that gathers the latest data from diverse sources), the Burgas region can bridge the science-stakeholder-policy gap, raise citizens' awareness, and improve the use of existing data.

The Burgas region has introduced innovative community-involving planning solutions and enhanced flood risk prediction. It implements multifunctional nature-based solutions which also mitigate the effects of urban heat islands, address air pollution and increase urban resilience. The region is using digital simulations for knowledge-sharing and a tailormade climate resilience model to improve decision-making. A local climate resilience group that involves a wide range of stakeholders has been established to monitor, steer and consult on the implementation of pilot actions, as well as to suggest corrective measures where needed.

100KTREEs: Climate change adaptation in cities

The ambition of the HORIZON Europe project 100KTREES is to make cities a better and healthier place to live by encouraging municipalities to plant more trees and to optimize the impact of tree planting by leveraging Copernicus data. The benefits of urban trees planting include: improvements in air quality, increasing carbon sequestration, reduction of urban heat islands, improvement in urban biodiversity, reduce risk of pluvial flooding, reduce noise levels. In particular, the project is developing a toolbox were valorisation of tree impacts, cost benefit analysis, and what-if scenarios (long and short term) are considered, providing valuable business cases for the end-users for planting trees in cities and effectively implement climate adaptation strategies. During the development of the 100KTREEs toolbox, two end-users represented in the consortium, the city of Copenhagen and the city of Sofia, will be proactively engaged for continued feedback on its usability and utility. Co-creation workshops will be organized to collect the requirements of the involved municipalities. At the end of the project the toolbox will be offered to city clients as SaaS (Software as a Service).



Destination Earth's Digital Twins enhancing climate resilience

This pioneering information system, once ready, will enable the testing of adaptation options and policies, considering the evolution of the Earth system in a warming world. At its core are several innovative components including two digital twins, and an AI-enabled digital ecosystem which intends to connect users to a portfolio of novel applications and services.

The Weather-Induced Extremes Digital Twin offers global information at kilometer-scale resolution for several days ahead, also creating a capability to 'zoom in' on severe events across Europe. It intends to support authorities to safeguard lives and properties, and prepare for extreme events in a warming world.

To help adapting to the future climate, the Climate Digital Twin will enable the use of next-generation kilometer-scale climate models, delivering data and impact-relevant climate indicators both regularly and on-demand. This advancement will support climate-related actions, such as risk assessments, and at a later stage the assessment of adaptation options.

CHAPTER 6

Aligning investments with climate neutrality

Cycling & sustainability, generation alpha

by Anita Mókus, Hungary

"Let's educate our children about environmental protection, reduce the effects of global warming by cycling. The future is in the hands of our children, and our children are in our hands. Our common goal is to protect the planet. Let's join forces to make a positive change. Water (rain) & trees & planet - happy kids."

Key highlights

- Becoming climate neutral by 2050 is going to require substantial amounts of public and private resources: around 3.2% of GDP per annum for the energy systems (energy supply and demand) in 2031-2050. This implies an additional investment of 1.5% GDP per year compared to investments in the previous decade. Aligning finance flows with the climate neutrality and resilience pathway is key to achieve the EU's objectives.
- The impact of the Sustainable Finance Framework in mobilising green investments in the EU is significant and gaining momentum and the share of green bonds in total bond issuance is increasing.
- It is estimated that over the 2021-2027 period climate finance under the EU budget and the post recovery NextGenerationEU instrument combined will amount to 658 billion (over 34% of total budget commitments). Climate-related expenditure is mainstreamed in all major spending areas including the Recovery and Resilience Facility, Cohesion Policy, the Common Agricultural Policy, the Connecting Europe Facility and the EU's research programme Horizon Europe.
- In addition, climate action is financed by EU ETS revenues. In 2023, EUR 7.4 billion was raised for the Modernisation and Innovation fund, and EUR 36.2 billion was distributed through Member States' budgets.
- All these funds supported, for example, renewable energy sources, energy efficiency of buildings, competitiveness of EU's industry and agriculture, development of clean technologies, preparedness for climate change impact or skills for green jobs.

6.1 Investment needs and trends in the EU

Becoming climate neutral by 2050 calls for substantial amounts of public and private investments. Energy system investment needs[117] are estimated at around EUR 565 billion per annum (equivalent to 3.3% of GDP) in 2021-2030 and EUR 660 billion per annum (equivalent to 3.2% of GDP) on average over 2031-2050 (against EUR 250 billion over 2011-2020, or 1.7% of GDP, a decade with relatively low investments in the energy system), and yearly spending for transport[118] to about EUR 785 billion in 2021-2030 and EUR 870 billion in 2031-2050 (equivalent to 4.2% of GDP, a similar proportion of GDP as in 2011-2020)[119]. These figures do not include investments on nature preservation and restoration, also key to reach climate neutrality. This highlights the importance of further aligning climate finance with the climate neutrality and resilience objective of the EU, as also called for in the Paris Agreement.

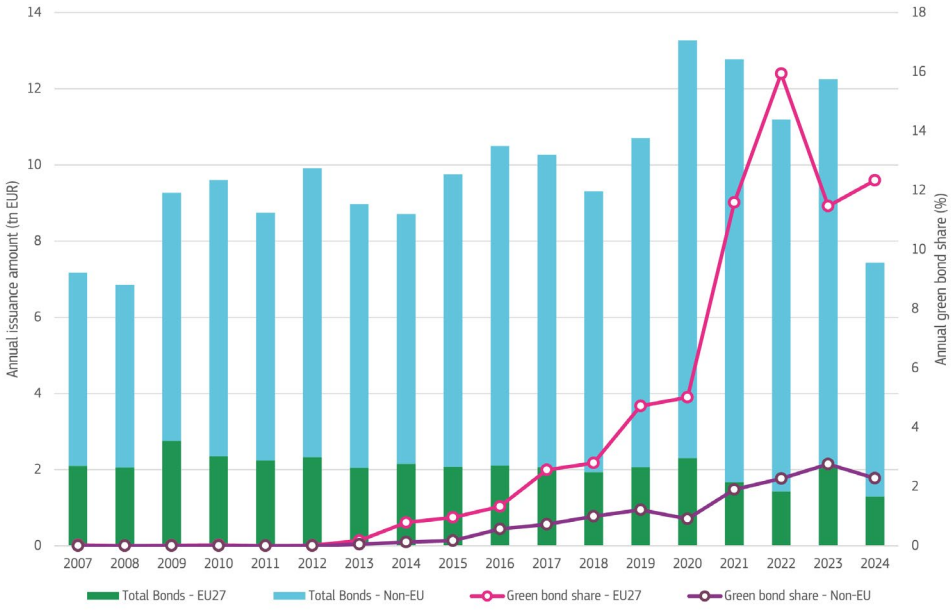
Given the scale of investment needed, the involvement of the private sector in financing the climate transition will be substantial. This is why the EU has over the last 5 years in addition to the economic incentives for private investment provided by ETS carbon pricing put together a framework aimed at facilitating private investments in sustainable activities. This Sustainable Finance Framework provides investors with robust definitions of green activities (EU Green Taxonomy[120]) as well as requiring companies and banks to disclose their impact on the environment and climate (Corporate Sustainability Reporting Directive[121], Sustainable Finance Disclosure Regulation[122]).

117 It should be noted that the term 'investment' is in this context more broadly defined than gross fixed capital formation in national accounts and includes elements of final consumption expenditure. Investment in the energy system includes capital expenditure by firms on the energy supply side (power generation and the grid, as well as hydrogen or e-fuel production) and capital expenditure for decarbonisation in industrial sectors. On the energy demand side, it includes investment in the energy efficiency of buildings (gross capital formation) and expenditure to decarbonise heating and cooling or improve the energy efficiency of appliances (consumption of durables goods by households).
118 Investments in the transport sector reflect the expenditures on vehicles, rolling stock, aircraft and vessels plus recharging and refueling infrastructure. They do not cover investments in infrastructure to support multimodal mobility and sustainable urban transport. In particular, the acquisition costs of private vehicles represent about 60% of the total.
119 For more details, see COM(2024) 63 final and associated SWD(2024) 63 final.
120 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0852
121 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2464
122 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088

The latest two additions to this framework are the regulation establishing the European Green Bond Standard[123] (October 2023) and the regulation on sustainability ratings (April 2024). The latter is going to require agencies that rate companies against sustainability criteria, to be more transparent about their methodologies and eliminate potential conflicts of interests. The former requires bond issuers to demonstrate that proceeds from their 'green' bonds predominantly go to Taxonomy-aligned activities.

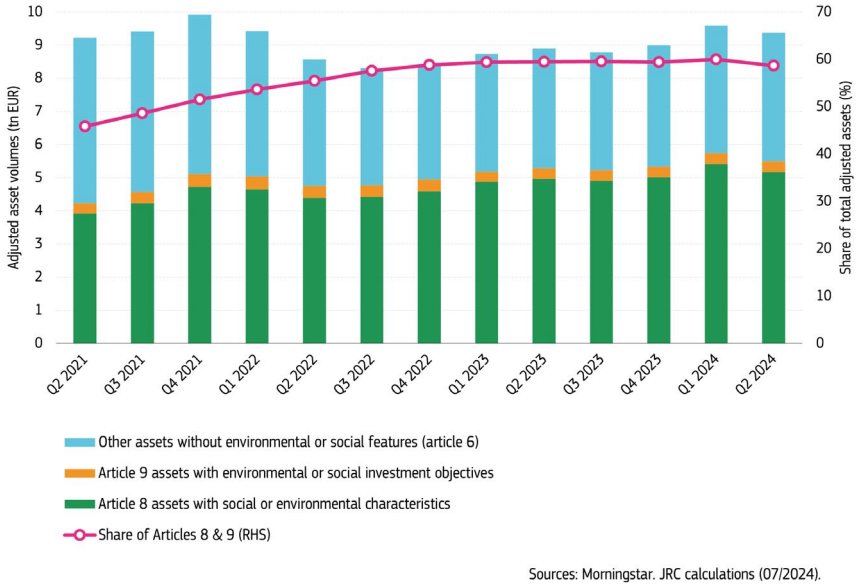
The impact of the Sustainable Finance Framework in mobilising green investments in the EU is significant and gaining momentum. For instance, the share of green bonds in total bond issuance rose sharply from 12% in 2021 to its 2022 peak at 16%. Even though this share retreated in 2023 (11%), as of 30 June 2024, green bonds are on an upward trend towards 13% of total bond issuance (see Figure 6.1).

Figure 6.1: Issued volumes – All bond types[124]



In the second quarter of 2024, green financial assets represented 58.6% of total assets under management by financial actors. Figure 6.2 presents the value and proportion of financial assets as categorised by the Sustainable Finance Disclosure Regulation.

Figure 6.2: Assets under management by SFDR classification[125]



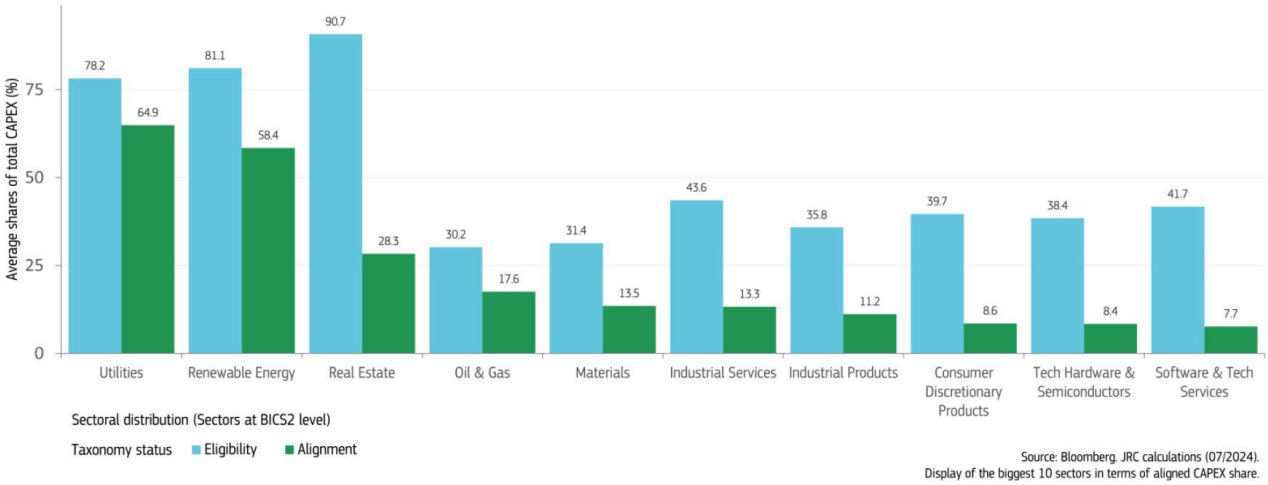
Sources: Morningstar, JRC calculations (07/2024).

123 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302631
124 Data as of 30 June 2024.
125 Light green assets: assets that promote environmental or social characteristics (Art. 8 of the Sustainable Finance Disclosure Regulation); Dark green assets: assets that have sustainable investment as their objective (Art. 9 of the Sustainable Finance Disclosure Regulation); Light blue assets: assets without environmental or social features (Art. 6 of the Sustainable Finance Disclosure Regulation). Data as of 30 June 2024.

The number of companies reporting how green they are in accordance with the EU Green Taxonomy is still limited, amounting to 1 769 in 2023 according to Bloomberg data. This number is set to increase over the coming years as more entities progressively fall within the scope of the Taxonomy Regulation.

Figure 6.3 ranks economic sectors following two metrics: Taxonomy-eligibility, which is the average proportion of capital expenditure by reporting firms in each sector on activities covered by the Taxonomy (regardless of their compliance); and Taxonomy-alignment, the average proportion of capital expenditure by reporting firms in each sector on activities that (actually) comply with relevant Taxonomy criteria. The below figures are however affected by the fact that the Taxonomy does not incorporate all economic activities yet.

Figure 6.3: Taxonomy – Average share of eligible and aligned CAPEX in 2023[126]



6.2 EU Funding from the EU Emission Trading System

The revenue from the auctioning of allowances in the EU ETS accrues mostly to Member States' budgets. Member States are obligated to use all ETS revenue (or an equivalent financial value) to fund climate action and energy transformation. ETS revenue is also distributed through financial instruments – the Innovation Fund and the Modernisation Fund. In 2023, the total ETS revenue amounted to EUR 43.6 billion. Of this revenue, EUR 7.4 billion was raised for these funds.

The **Innovation Fund** is the EU fund for innovative climate actions, with a focus on energy and industry. It aims to bring to the market solutions to decarbonise European industry and support its transition to climate neutrality while fostering its competitiveness. With EUR 40 billion estimated budget available (based on a carbon price of EUR 75/tCO_2), the Innovation Fund has launched eight calls for proposals, including one for auctions under the European Hydrogen Bank.

The Innovation Fund portfolio of ongoing projects counts around 120 large and small-scale projects under implementation, with grants amounting to around EUR 7.2 billion. The results of the 2023 Innovation Fund Call were published in the second half of October 2024. This Call had a record budget of EUR 4 billion and received 337 applications. The first-ever Innovation Fund Auction in 2023 attracted 132 bids from 17 countries across Europe, requesting funds that 15 times greater than the available budget. The results of the evaluation were published at the end of April 2024, with 7 bids selected for grant agreement preparation requesting EUR 720 million of EU contribution. The selected projects submitted bids between EUR 0.37 and EUR 0.48 per kilogram of renewable hydrogen produced and, based on the pay-as-bid design of the pilot auction, they will receive Innovation Fund grants ranging from EUR 8 million to EUR 245 million. Payments will only be provided upon presenting certified and verified volumes of renewable hydrogen. The grant agreements were signed in October 2024.

EU Member States (as well as EEA countries) also have the possibility to participate in Innovation Fund auctions with their own budget, benefitting from faster state aid clearance. This allows countries to use the auction to allocate additional national funds to national projects that could not be supported from the Innovation Fund auction budget. Germany has contributed EUR 350 million to a national funding window in the pilot auction. Similarly, the Commission is working to set up a similar feature for the regular calls for proposals, called 'Grants-as-a-Service'. Both features allow Member States to make use of the well-established Innovation Fund evaluation procedures and avoid unnecessary administrative burdens to develop and run new support schemes for the same technologies.

126 Data as of 30 June 2024.

The **Modernisation Fund** supports lower-income Member States with financial assistance, generated through the ETS, to modernise their energy systems and improve energy efficiency. Up to 2030, over 750 million allowances will be auctioned to support these Member States, an increase by 110 million allowances (representing around EUR 60 billion), thanks to the revision of the ETS Directive. Three more Member States, Slovenia, Portugal and Greece became eligible for the Fund following the revision of the ETS Directive[127], bringing the total number of beneficiaries to 13.

The total disbursements from the Modernisation Fund since January 2021 amount to around EUR 12.7 billion. In June 2024, the Commission adopted the seventh disbursement decision under the Fund. On this basis, the EIB made payments for a total of EUR 3 billion to ten beneficiary Member States (See Table 6.1).

Table 6.1: Payments from Modernisation fund in June 2024

Member State	Payments (EUR million)
Romania	1 095.0
Czechia	835.2
Poland	697.5
Hungary	76.8
Bulgaria	65.2
Lithuania	59.0
Croatia	52.0
Slovakia	35.0
Latvia	26.8
Estonia	24.1

As a next step, the beneficiaries will have to transfer the money from the Modernisation Fund to the project proponents or the schemes' managing authorities. The next deadline for beneficiary Member States to submit investment proposals for potential support by the Modernisation Fund was 13 August 2024 for non-priority proposals, and 10 September 2024 for priority proposals.

6.3 Mainstreaming climate policies in the EU budget

The EU budget 2021-2027 – both the 'multiannual financial framework' and the NextGenerationEU instrument – is an important enabler of the green transition. It is currently projected that in the period up to 2027 it will contribute EUR 658 billion to climate action. This represents 34.3% of the EU's total budget[128] and exceeds its 30% climate spending target. This target is underpinned by programme-specific spending targets, for instance in the European Regional Development Fund (30%), the Neighbourhood, Development and International Cooperation Instrument (30%), Horizon Europe (35%), the Cohesion Fund (37%), the Common Agricultural Policy (40%), the Connecting Europe Facility (60%), and the LIFE programme (61%).

The EU's Recovery and Resilience Facility – the centrepiece of NextGenerationEU, the EU's recovery instrument – has a value of up to EUR 648 billion[129] and enables Member States to significantly increase climate investments. To qualify for the Facility's grants (EUR 357 billion) and loans (EUR 291 billion), Member States have prepared recovery and resilience plans setting out investments and policy reforms that contribute to the Facility's six policy objectives including the green transition. Each national plan must spend a minimum of 37% of its total allocation on measures contributing to climate objectives (such as initiatives promote energy efficiency, sustainable mobility, and renewable energy). Every measure must also comply with the 'do-no-significant-harm' principle[130]. All 27 Member State plans exceed the 37% benchmark, with some Member States spending well over half of their allocation to fund climate policy. Collectively Member States dedicate 43% of their allocations to climate objectives (EUR 275 billion) [131].

127 By Directive (EU) 2023/959.
128 Refer to data in draft budget 2025.
129 In 2022 prices.
130 Commission Notice – Technical guidance on the application of do no significant harm under the Recovery and Resilience Facility Regulation (europa.eu)
131 Add most recent source.

In addition, in 2023 and 2024, Member States were complementing their recovery and resilience plans with new chapters on REPowerEU in response to the energy crisis caused by Russia's invasion of Ukraine. New or scaled-up reforms and investments in Members States to help phase out the EU's dependence on Russian fossil fuels and accelerate the clean energy transition are supported by additional financial power (EUR 20 billion of new grants, transfers from other funds and use of remaining NGEU loans). At the same time, the 2021-2027 EU budget is enhancing its focus on the results of the measures that it finances. For example:

- Annual energy consumption so far have been reduced by more than 34 terawatt thanks to the Recovery and Resilience Facility;
- According to Cohesion Policy programmes 30 157 211 square metres of public buildings will see their energy performance improve;
- Similarly, 9 504 gigawatts of additional renewable energy will be financed by the Cohesion Policy funds.

Strategic Technologies for Europe Platform

The Strategic Technologies for Europe Platform (STEP) is a new EU initiative launched on 1 March 2024[132]. It aims to strengthen the EU's industrial competitiveness and reduce external dependencies by funding the development and manufacturing of critical technologies in the EU, reinforcing their value chains, and reducing shortages of essential labour and skills. The STEP supports investments in three key technology fields:

- clean and resource-efficient technologies, which are of key importance to the climate transition,
- digital and deep tech innovation, and
- biotechnologies.

Clean and resource-efficient technologies include net-zero technologies defined in the Net-Zero industry Act[133] such as technologies based on solar energy, battery and energy storage, hydrogen, carbon capture and storage, nuclear-related technologies, including nuclear fuel cycle technologies, renewable fuels of non-biological origin. STEP also addresses shortages of labour and skills critical to jobs connected to these technologies.

STEP is not a new funding instrument, but it leverages and synergises resources from various EU funding programmes such as Innovation fund, Horizon Europe, and Cohesion Policy funds.

In the Cohesion Policy, STEP introduced new possibilities and flexibilities such as 100% co-financing rate or one-off 30% prefinancing of STEP dedicated priorities, and thus it can boost investments in clean and resource-efficient technologies. 29 programmes have formally submitted STEP related amendments, or are in the stage of informal discussion.

InvestEU

At least 30% of the InvestEU programme's target of EUR 372 billion for mobilising additional investment over the period 2021-27 should contribute to meet the EU climate objectives. Under the Sustainable Infrastructure Window, 60% of the funding must be spent on climate and environment. Investments above EUR 10 million are subject to sustainability proofing (identify, assess and mitigate climate, environment or social risks). All InvestEU supported investment will be climate and environmentally tracked against the methodology issued by the Commission. Implementing partners have been so far selected through two calls for expressions of interest and respective signing of guarantee agreements (in 2022 and in 2023)[134]. Financial products foreseen will help address market failures in providing access to finance projects in a broad area of policy priorities from transport, smart mobility, clean energy, digital connectivity, as well as energy efficiency, decarbonisation of industry, renewable energy, circular economy and other fields. By mid-2024, the Investment Committee had approved 216 InvestEU operations for EUR 21.9 billion in guarantees (including Member State Compartment). As of end 2023, InvestEU reported to have helped mobilise EUR 217.5 billion in investments (58.4% of the target). Both climate/environmental targets have been overachieved, the climate contribution amounted to 53% (as compared to the expected 30%) and the climate and environmental contribution of the Sustainable Infrastructure Window amounted to 86% (as compared to the expected 60%).

132 Regulation (EU) 2024/795 of the European Parliament and of the Council of 29 February 2024 establishing the Strategic Technologies for Europe Platform (STEP), and amending Directive 2003/87/EC and Regulations (EU) 2021/1058, (EU) 2021/1056, (EU) 2021/1057, (EU) No 1303/2013, (EU) No 223/2014, (EU) 2021/1060, (EU) 2021/523, (EU) 2021/695, (EU) 2021/697 and (EU) 2021/241

133 Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending Regulation (EU) 2018/1724

134 Besides the EIB (which covers 75% of the EU guarantee), 16 institutions have signed guarantee agreements, including the European Bank for Reconstruction and Development (EBRD), Council of Europe Development Bank (CEB), Nordic Investment Bank (NIB), CDP Equity (CDPE), Caisse des Dépôts (CDC) in 2022.

Horizon Europe

Horizon Europe[135] is the EU's key funding programme for research and innovation. Research and innovation enable the green transition by testing and demonstrating solutions, developing breakthrough innovations and knowledge for policies based on the latest scientific evidence. Horizon Europe will devote in the 2021-2027 timeframe at least 35% of its EUR 95.5 billion budget to support climate action objectives. Horizon Europe invested over EUR 14.7 billion in climate action by the end of 2023. This covers projects in the thematic areas of climate science, energy supply, storage and systems, clean transportation, industry decarbonisation, climate adaptation, carbon removals, and agriculture. The June 2023 report 'Scaling up innovative technologies for climate neutrality' provides a view of more than 180 demonstrators of technologies funded mostly by Horizon Europe and the Innovation Fund that enable climate neutrality[136].

LIFE programme

The LIFE Programme is the EU's funding instrument for the environment, energy and climate action. Its general objective is to facilitate the transition towards a sustainable, circular, energy-efficient, renewable energy-driven, climate-neutral, and resilient economy. Within its four subprogrammes, the LIFE subprogramme on Climate Change Mitigation and Adaptation supports the implementation of the Green Deal by contributing to the objectives and targets set out in the EU Climate Law.

In 2023, the LIFE Programme approved 34 projects under the LIFE Climate Change Mitigation and Adaptation subprogramme, with an estimated funding of EUR 65 million. These projects focus on key areas of the climate transition, such as carbon removals in agricultural and forest lands, climate adaptation in urban and rural areas and greater preparedness for extreme weather events. Additionally, in 2023, the Programme financed three strategic projects aimed at implementing EU climate legislation in Member States, with a contribution of EUR 33.5 million.

Technical Support Instrument

In 2023, the Commission supported Member States through the Technical Support Instrument[137], providing tailor made technical expertise to design and implement reforms. This included several projects on climate change adaptation, the implementation of the do-no-significant-harm principle, faster permitting, industrial eco-systems and skills, renovation of buildings and capacity building. In particular, the Commission helped Member States to identify reforms and investments to phase out fossil fuel imports from Russia in preparation for the REPowerEU chapters. In 2024, the Commission is supporting Member States to enhance the greening of public administrations, make energy systems fit for the green and digital transition, and support the resilience of natural resources. The Commission is also helping Member States implement the revised EU Emissions Trading System and the Carbon Border Adjustment Mechanism, as well as prepare national Social Climate Plans under the Social Climate Fund.

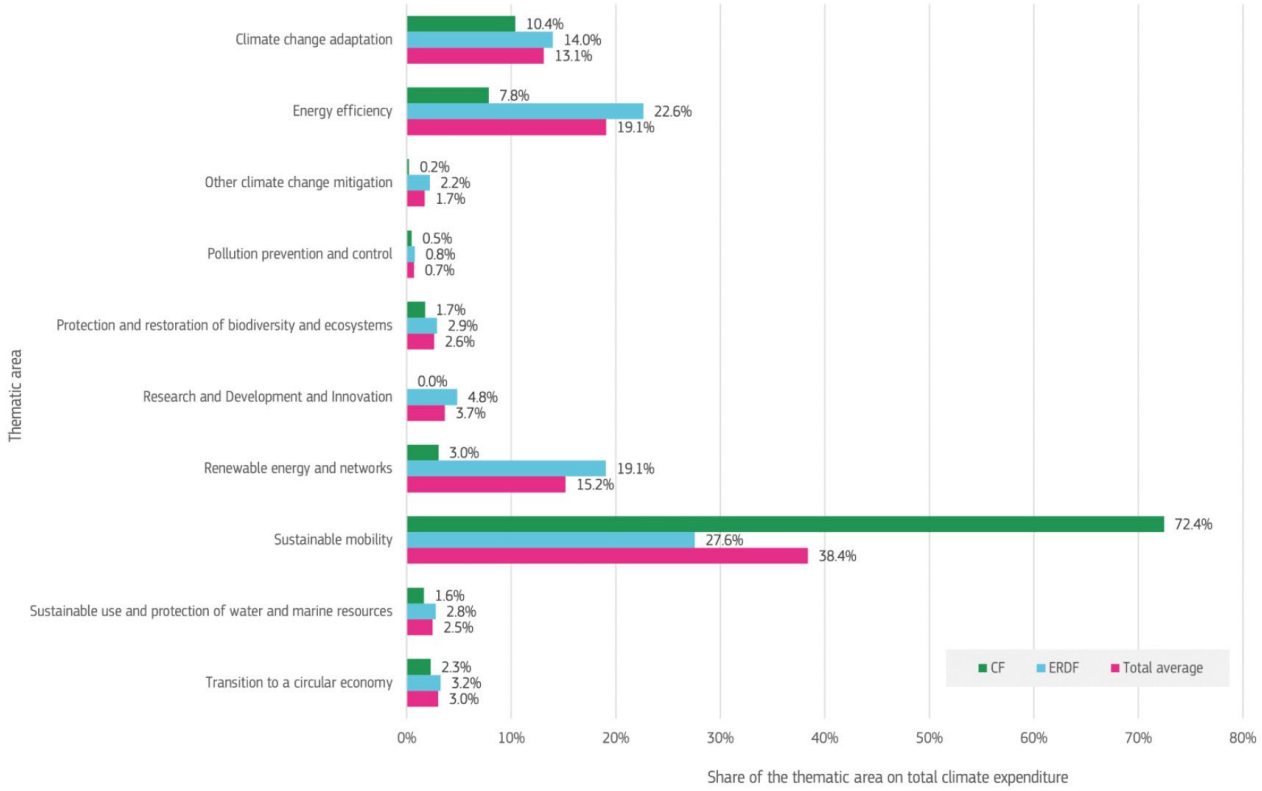
135 And its predecessor Horizon 2020 in the 2014-2020 period.
136 https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/2f1ec1d2-1173-11ee-b12e-01aa75ed71a1
137 The Technical Support Instrument (TSI) is the EU programme that provides tailor-made technical expertise to EU Member States to design and implement reforms. Additional information is available here: https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/technical-support-instrument/technical-support-instrument-tsi_en

6.3.1 Cohesion Policy

European Regional Development Fund, Cohesion Fund, and Interreg

Member States' have allocated respectively 56.9% (EUR 22.2 billion) of their Cohesion Fund (CF) and 32.6% (EUR 69.9 billion) of their European Regional Development Fund (ERDF) allocations to climate action. In addition, about 24.4% of the EUR 10.7 billion of Interreg funds[138] financed by the EU are expected to fund climate relevant measures. Figure 6.4 shows the funding allocated to climate relevant policy areas as a share of total ERDF, CF, and Interreg climate expenditure.

Figure 6.4: Distribution of cohesion policy funds climate allocation by thematic area



Just Transition Fund

The Just Transition Fund (JTF) programmes mobilises EUR 19.2 billion of EU investments to help the people and places that suffer the most from the transition to climate neutrality. In addition to JTF, the other 2 pillars[139] of the Just Transition Mechanism will mobilise EUR 28 billion from public and private investments to address the social and economic effects of the transition. The Commission has approved all 70 Territorial Just Transition Plans, covering a total of 96 coal regions and carbon intensive regions. Where just transition regions need support, the Commission provides technical and advisory support through the Just Transition Platform (JTP) launched in February 2023.

Almost half of JTF investments will support diversification of the local economy, so that they do not depend on a single polluting sector, and help people acquire new skills. Moreover, the JTF will invest EUR 8.2 billion in skills and economic diversification. Up to 120 000 unemployed people will benefit from the measure and almost 200 000 people will gain new skills.

As a part of the STEP framework, the one-off pre-financing (30%) was applied to all JTF resources thus providing higher liquidity for project implementation. As a result the Commissionalready paid EUR 5.9 billion in JTF pre-financing to accelerate the support to regions most affected by the transition towards climate neutrality.

JTF implementation has seen an upward trend as the EU-level selection rate reached 6.1% of the total allocation (compared to 3.2% as of December 2023). There are notable differences in progress Malta has taken lead in the project selection, followed by Luxembourg and Netherlands. The Netherlands continue to be the best performer in absolute terms, securing ca. half a billion euros for selected projects.

138 Programmes focused on European territorial cooperation. Additional information is available here: https://interreg.eu.
139 InvestEU "Just Transition" scheme and Public Sector Loan Facility.

European Social Fund (ESF+)

For the period 2021-2027, Member States programmed almost EUR 6 billion or about 6% of total ESF+ allocations[140] for green skills and green jobs, considerably more than in the previous programming period. Finland, Italy, Belgium, Luxembourg, and Denmark allocated the highest shares to green jobs and skills (between 12% and 31%) while in several individual programmes from Belgium, Denmark, Italy, France, Germany, Portugal and Spanish programmes this share is 20% and above. In terms of actual investments, three individual programmes from Italy, Portugal and Greece alone contribute to some 30% of total EU climate expenditure for green jobs and skills. Overall, a third of climate expenditure has been allocated to access to employment and activation measures.

Examples of funding of climate related projects

SHEEFT: Solar Heliup Energy for flat rooftops

The IF has granted EUR 3.2 million to a solar photovoltaic (PV) panel project in Le Cheylas in France. Thanks to the IF's support, SHEEFT will deploy industrial-sized manufacturing of ultra lightweight solar PV panels designed for existing large building rooftops with low bearing capacities.

SHEEFT's innovative nature lies in its installation concept, which involves directly bonding the panel to a waterproofing membrane, thus reducing weight by 60% compared with conventional solutions. This technology, which is well adapted to flat rooftops and is weather resistant, is based on a patented design that uses ultra-thin glass.

In line with the REPowerEU plan, the project's production capacity is set at 100 megawatt peaks (MWp) per year and aims to avoid 363 660 tonnes of CO_2 equivalent over a 10-year period. The project will create 100 direct jobs and 150 indirect jobs. It is scheduled to begin operating in late 2024.

Support Scheme to produce electricity from renewable energy in Romania.

In 2024, the Modernisation Fund made a first tranche of EUR 5 million to Romania to implement a contract for difference support scheme. This scheme seeks to develop 5 gigawatts (GW) of onshore wind and solar photovoltaic (PV) capacities through two auctions between 2023 and 2025, aiming to support 50-250 beneficiaries of all sizes.

Led by the Romanian Ministry of Energy, this scheme works as a variable premium payment for each megawatt hour (MWh) of electricity generated and delivered to the grid. The payment is calculated based on the difference between a competitively fixed price (strike price) and the market price (reference price). The total support from the Modernisation Fund for the scheme will be determined following the two auction rounds, based on the actual strike prices.

The objectives for this scheme are well-aligned with the RePowerEU plan and the Green Deal Industrial plan as the scheme is contributing to increasing the share of renewable energy sources in the energy mix and reducing greenhouse gas emissions. The scheme also supports the national decarbonisation objectives of the 2021-2030 national energy and climate plan, with a focus on 2023-2025, while maintaining energy security and generation diversification. It will also aid the local economy with increasing jobs and skill diversification.

140 Open Data Portal for the European Structural Investment Funds - European Commission | Data | European Structural and Investment Funds (europa.eu).

International climate action

CHAPTER 7

Photo by
Kotsiras Anastios, Greece

"This photo was taken during our outdoor, eco-educational event for kids called 'Save Your Planet'. Through this project, we provide eco-education to children in classrooms, festivals, and museums across Greece. Additionally, the Ministry of Education of South Korea has incorporated our programme into their schools. The 'Save Your Planet' project includes activities that kids love. We have created two animated series, illustrated books, apps, and games. The animated series is broadcast worldwide, allowing us to educate kids and their families about environmental conservation. We aim to spread the message of saving the planet by encouraging small, easy changes in daily life that collectively make a significant impact. The 2 persons in the photo are my kids."

Key highlights

- At COP28 in December 2023, the first "Global Stocktake" under the Paris Agreement (GST), Parties signalled the actions needed to be taken by 2030, including the transition away from fossil fuels, tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements, among others.
- The EU's Climate Diplomacy is working to raise global efforts to tackle climate change through multilateral negotiations, plurilateral initiatives and bilateral dialogues. A dedicated Task Force on carbon markets was also set up that will assist in intensifying the EU's carbon market diplomacy.
- The EU, including its Member States and the EIB, is the biggest contributor of public climate finance for developing countries worldwide.

7.1 Overview and developments

The past year has seen productive, high-level international exchanges including the Copenhagen Climate Ministerial, the Petersberg Climate Dialogue, the Ministerial on Climate Action, the 28th Conference of the Parties (COP28) in Dubai, United Arab Emirates and the intersessional subsidiary bodies sessions hosted by the United Nations Framework Convention on Climate Change (UNFCCC) in Bonn (SB60).

At COP28, the Parties concluded the first Global Stocktake under the Paris Agreement, with decisions on accelerating action by 2030 and beyond, including the transition away from fossil fuels, tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030.

On adaptation, the Parties agreed upon the 'UAE Framework for Global Climate Resilience'. They also made progress on the modalities to deliver on the UAE-Belém work programme on indicators relating to the adaptation policy cycle and a set of thematic targets (e.g. water, food, agriculture and health).

For the mitigation work programme, the EU shared its experiences on energy transition, highlighting the role of renewable energy. It also emphasized its engagements to supporting the just energy transition outside of the EU. It was also active in the operationalisation of the just transition work programme, which includes a strong focus on the workforce and labour rights recognition.

The United Arab Emirates (UAE) Framework for Global Climate Resilience, which was also adopted at COP28, was the first in making climate adaptation as a top priority for all nations. Stemming from the Global Goal on Adaptation established in the Paris Agreement in 2015, it identifies global adaptation targets and launches the 2-year UAE-Belém work programme, to establish indicators for measuring progress towards these targets. The targets and future indicators will drive further developments in EU climate adaptation policy and action. The EU and its Member States are actively contributing to the UAE Framework and the UAE-Belém work programme on indicators.

On loss and damage, COP28 achieved a successful operationalisation of the funding arrangements including a Fund for assisting developing countries particularly vulnerable to the adverse effects of climate change. The EU and its Member States contributed more than EUR 400 million, over two thirds of the initial funding pledges.

The EU is engaged in the ad hoc work programme for the New Collective Quantified Goal on climate finance, that is expected to be decided at COP29. The goal is meant to support action to tackle the climate emergency and contribute to making all financial flows consistent with the Paris Agreement.

In October 2023, the EU submitted an updated NDC to the UNFCCC that provides more clarity, transparency and understanding on the policies put in place to achieve its target of reducing emissions by at least 55% compared with 1990 levels by 2030, as submitted in December 2020[141].

Meanwhile, the EU is calling for all Parties to be as ambitious as possible in their new NDCs, which they will submit ahead of COP30. The EU is also calling for submission of the first Biennial Transparency Reports by the end of 2024.

The EU launched and promoted the Global Renewables and Energy Efficiency Pledge[142]. As a result, at COP28, Parties to the Paris Agreement agreed to contribute to tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030. The EU has also endorsed other plurilateral initiatives such as the COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action[143], the Climate Recovery and Peace Declaration on Climate Finance[144], Getting ahead of Disasters: a Charter for a Better Future[145], the COP28 Declaration on Climate and Health[146] and the Climate Club[147] to speed up the decarbonisation of hard-to-abate industrial sectors.

On 7 May 2024, as a domestic contribution to the Global Methane Pledge[148] launched in 2022, the EU adopted, the first EU-wide legislation to reduce methane emissions in the energy sector. Similarly, in the waste sector, the EU contributed to the launch of the Lowering Organic Waste Methane (LOW-Methane)[149] initiative at COP28, under the Global Methane Pledge umbrella.

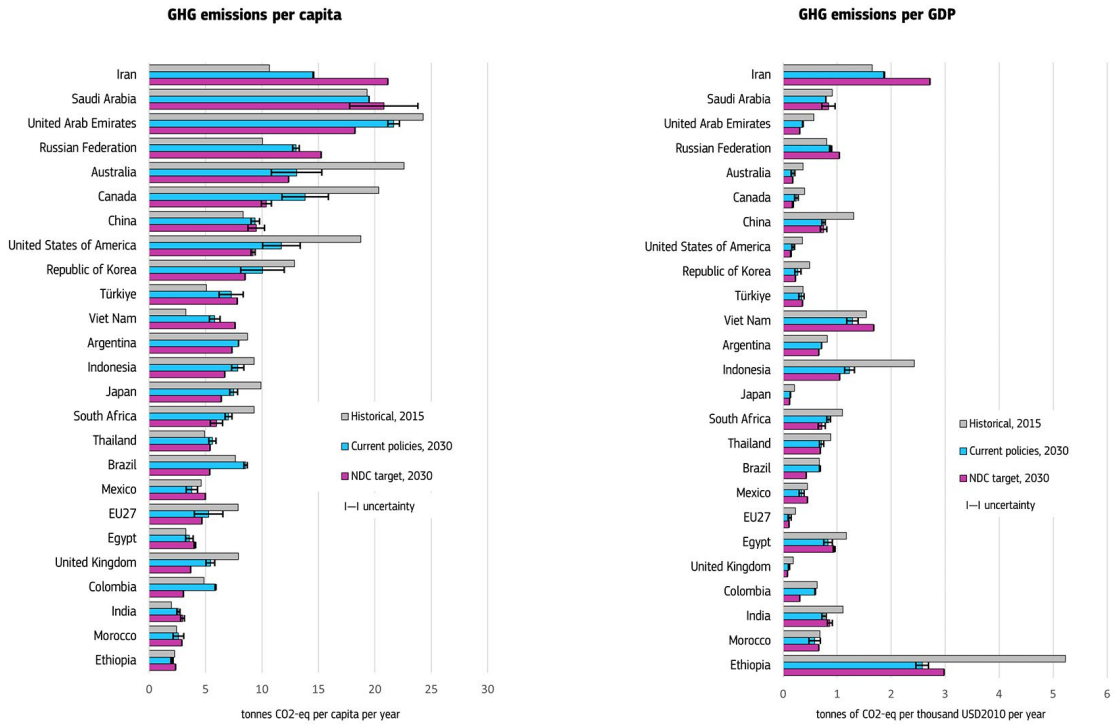
Lastly, to achieve a coordinated approach in tackling climate change, land degradation, desertification and biodiversity loss, the EU is working on enhanced collaboration between the different Conventions, including the Kunming-Montreal Global Biodiversity Framework adopted in 2023, to halt and reverse biodiversity loss.

141 https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf
142 https://energy.ec.europa.eu/system/files/2023-12/Global_Renewables_and_Energy_Efficiency_Pledge.pdf
143 www.cop28.com/en/food-and-agriculture
144 www.cop28.com/en/cop28-declaration-on-climate-relief-recovery-and-peace
145 www.early-action-reap.org/our-vision-getting-ahead-disasters-charter
146 www.cop28.com/en/cop28-uae-declaration-on-climate-and-health
147 https://climate-club.org
148 www.globalmethanepledge.org
149 https://energy.ec.europa.eu/news/2023-global-methane-pledge-ministerial-decisive-action-curb-emissions-2023-12-04_en

7.2 Multilateral and Bilateral engagement

Significant progress is made with multilateral and bilateral partners to convince and support other countries, in particular major emitters, to increase their climate ambition, and accelerate their clean energy transition. About half of the countries analysed in Figure 7.2 are on track to meet their targets. The EU is advancing with its support for other countries, , in particular major emitters, to increase their climate ambition, and accelerate their clean energy transition. The overview also shows that the EU is projected to meet its Paris-aligned NDC target through the implementation of policies adopted at the EU level, specifically the Fit for 55 legislative proposal and the REPowerEU plan.

Figure 7.2: Impact of current policies on greenhouse gas emissions in major emitting countries[150]



The EU has worked with multilateral platforms, such as the United Nations (where it participated in the UN General Assembly in September 2023), the G7/G20 and the OECD, as well as in the WTO, to generate transparency on efforts, mobilise resources and share knowledge on climate action. In 2023, the EU worked with NATO and the Organisation for Security and Cooperation in Europe to increase engagement with the impact of environmental degradation and climate change on peace, security and defence.

Regular bilateral exchanges took place with international partners at both political (e.g. in the form of High-Level Dialogues) and technical level, in particular with major emitters, such as the United States, China, Japan and the Association of Southeast Asian Nations (ASEAN) countries.

To intensify its carbon market diplomacy, the Commission set up a dedicated **Task Force on carbon markets**, to amplify efforts to replicate the success of the EU ETS by encouraging and supporting other jurisdictions to introduce or improve their own carbon pricing mechanisms. The task force will also enable the EU's engagement with stakeholders to ensure the climate integrity of international carbon markets and their alignment with Paris Agreement objective.

Progress was also made in implementing existing Green Alliances (Japan and Norway) and Green Partnerships (Morocco and the Republic of South Korea) with strengthened dialogue and cooperation in areas of relevance to the green transition. A new Green Alliance with Canada was concluded in November 2023 and negotiations are ongoing on the establishment of a Green Partnership with Kenya.

The EU together with other members of the International Partners Group continued to work on the Just Energy Transition Investment Partnerships (JETP) providing EUR 2.5 billion in new public and private financing.

150 Source: PBL FAIR/TIMER Model; New Climate Institute calculations; IIASA GLOBIOM/G4M Model (2003); published in Greenhouse gas mitigation scenarios for major emitters; L Nascimento, T Kuramochi, S Woollands, M Moisio, A Missirliu, J Wong, H Fekete...2023, pbl.nl. Greenhouse gas emissions intensity per capita and per GDP in 2030 under current policies (adopted up until July 2023), NDC scenarios and historical 2015 levels. Targets are set by the respective country and are not necessarily aligned with the temperature goal of the Paris Agreement. The NDC target figures refer to unconditional target, except for Egypt. The sectoral emissions coverage of the scenarios for each country is aligned with the scope of the NDC. Figure sorted by NDC per capita values. https://newclimate.org/sites/default/files/2023-11/NewClimate_PBL2023_CurrentPolicies.pdf

At COP28 in December 2023, South Africa unveiled the Implementation Plan of its JETP (signed in 2021), which includes the new areas of renewable energy manufacturing and energy efficiency, thereby expanding the range decarbonisation investments by JET Partners.

The Comprehensive Investment and Policy Plan, which was launched in November 2023 with **Indonesia**, sets out the details of the USD 20 billion finance package of public and private funds and outlines policy reforms for energy sector decarbonisation. In February 2024, the EIB signed a memorandum of understanding with the goal of finalising a framework loan of up to EUR 500 million to support the JETP (signed 2022).

At COP28, together with the International Partners Group, Vietnam launched its Resources Mobilisation Plan for the JETP (signed 2022). The plan includes an assessment of priority investments which supports progress on the pathway to net-zero emissions and the identification of a set of priority policy actions and regulatory reforms to develop an enabling environment.

The new Political Declaration establishing a JETP with Senegal includes Senegal's commitment to increase the share of renewable energies in installed capacity to 40% of its electricity mix by 2030, and to develop a long-term low GHG emission development strategy (LTS).

The EU is also engaging with the Contracting Parties of the Energy Community on the way forward with carbon pricing in the Western Balkans, Georgia, Moldova and Ukraine[151]. An impact assessment was launched by the European Commission to analyse different carbon pricing options.

Policy dialogues and cooperation activities were supported inter alia, through the EU Climate Dialogues programme, which fosters exchanges and collaboration among national and sub-national administrations, business communities, academia and civil society stakeholders with a view to making progress toward the Paris Agreement goals.

7.3 Climate Finance and International Cooperation

Together with climate finance from private sources, international public climate finance plays an important role in helping developing countries to implement the Paris Agreement.

The Commission continues to support partner countries through its financing instruments. Under the Neighbourhood, Development and International Cooperation Instrument (NDICI – Global Europe), with at least 35% dedicated to climate action. This includes actions in fragile and conflict affected settings in recognition of the complex interdependencies between climate change, environmental degradation, fragility and conflict.

The Instrument for Pre-Accession Assistance (IPA III) also sets a climate change spending target of 18%, rising to 20% by 2027. The Commission has committed an additional EUR 4 billion to climate finance by 2027 on top of these climate change spending targets, which equates to a 35% climate finance target. This is an unprecedented investment by the EU in reducing emissions and in helping developing countries build resilience to the effects of climate change.

The EU, its Member States and financial institutions, (collectively known as Team Europe), are the leading contributor of development assistance and the world's biggest climate finance contributor, accounting for about a third of global public climate finance. Over 54% of Team Europe finance has been allocated either to climate adaptation or to measures involving both mitigation and adaptation. Almost half of the total funding has been allocated via grants.

In 2022, the developed countries achieved the goal of providing USD 100 billion in climate finance goal to developing countries, which reflects the collective push for bold action. The EU and all its 27 Member States have moved the needle with a 24% year-on-year increase in public finance, which reached EUR 28.5 billion (roughly USD 30 billion)[152].

Efforts are also underway to promote the involvement of the private sector in climate action through the European Fund for Sustainable Development Plus (EFSD+) guarantees and blending. The EFSD+ provides a comprehensive set of tools, including guarantees, grants, technical assistance, and other support, to mobilise private sector investments for sustainable development in partner countries. It contributes, among others, to climate change adaptation and environmental protection and management. Offering a variety of risk-sharing instruments of up to EUR 40 billion, the EFSD+ aims to mobilise up to EUR 135 billion of public and private financing to help partner countries achieve the Sustainable Development Goals. Together with the private sector and the leverage effect, the EFSD+ is expected to mobilise more than half a trillion euros in investments for 2021-2027.

151 21st Energy Community Ministerial Council focuses on Treaty Extension, TEN-E Regulation, and carbon pricing - Energy Community Homepage (energy-community.org)
152 The final amount of the EU and all its MS contributions in 2023 to the USD 100 billion climate finance goal will be published closer to COP29 https://www.consilium.europa.eu/en/press/press-releases/2024/10/08/climate-finance-council-approves-conclusions-ahead-of-cop29

Examples of funding of climate related projects

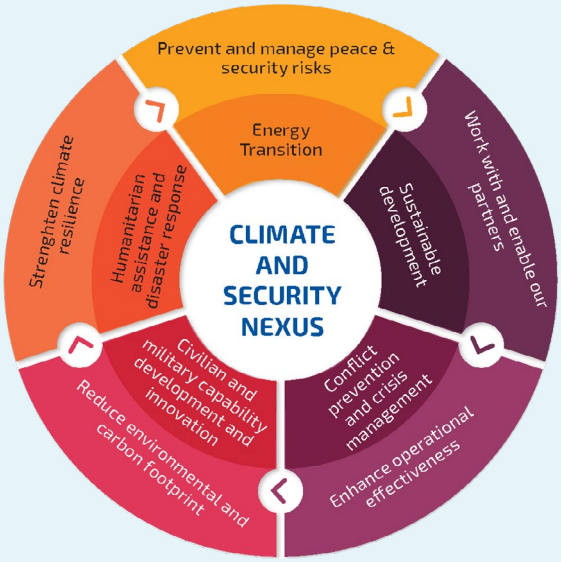
In June 2023, the Commission and the High Representative adopted a joint communication laying out how the EU will address the growing impact of climate change and environmental degradation on peace, security and defence.

The four main priorities of the Communication are to:

- **Strengthening planning, decision-making and implementation,** through reliable and accessible evidence-based analysis and data on the climate and security nexus;
- **Operationalising the response to environment, climate and security challenges in EU external action and instruments**;
- **Enhancing** climate adaptation and mitigation measures of EU Member States' **civilian and military operations and infrastructure** to lower costs, carbon footprints, while maintaining operational effectiveness;
- **Reinforcing international partnerships** through multilateral, plurilateral and bilateral fora and with partners such as UN, OSCE, NATO, African Union.

Copernicus' Emergency Management Service plays an important role in supporting early-warning capacities, as well as the Copernicus Land Monitoring Service providing geospatial information on land cover and its change, water cycle and Earth's surface energy variables.

Example of use of geospatial observation data and analysis:



Commission and EEAS services are producing an annual comprehensive climate and security trend analysis. Use of data, analysis and indicators on climate and environment-related risks is promoted, including by the establishment of a climate and security hub located at the EU's Satellite Centre.

The Commission and ESA are working together under the Joint RTD-EOP Earth System Science initiative to jointly advance Earth system science and its contribution in responding to the global challenges faced by society, including accelerating the use of Earth-observing satellites and the information which they provide to address climate change.

Technical information

Commission Staff Working Document (SWD)

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1. Overview of EU climate targets

Table 1.1: Overview of new climate targets as adopted under the Fit for 55 package

	International commitments		EU domestic legislation						
	The EU's commitment under the Kyoto Protocol (KP)	**The EU's commitment under the Paris Agreement**	**2020 Climate and Energy Package**		**2030 Climate and Energy Framework**				**2050**
			EU ETS	**Effort Sharing Decision (ESD)**	**EU ETS (ETS1)**	**ETS 2 for buildings, road transport and small-emitting industry[1]**	**Effort Sharing Regulation (ESR)**	**LULUCF**	
Target year of period	Second commitment period (2013-2020)	Already in force – covers the period post 2020	2013-2020		2021 - 2030				2050
Overall emission reduction target	-20%	at least -55% net emissions in 2030	-20% GHG emissions reduction vs 1990		at least -55% net domestic reduction vs 1990				
Emission reduction target			-21% in 2020 compared to 2005 for ETS emissions	-10% in 2020 compared to 2005 for non-ETS emissions Annual binding targets by MS ranging from +20% to -20%.	-62% in 2030 compared to 2005 for EU ETS emissions	-42% in 2030 compared to 2005 for ETS 2 emissions	-40% in 2030 compared to 2005 for ESR emissions (non- ETS1 emissions) Annual binding targets by MS ranging from -10% to -50%.	First phase 2021-2025 'no-debit' commitment to maintain current carbon sink levels. In a second phase 2026-2030: EU-wide target of -310 Mt CO_2 equivalent of net removals by 2030, each MS will have nationally binding 2030 targets	limate neutrality (Balance between emissions and removals)
Base year	1990, but subject to flexibility rules. 1995 or 2000 may be used as its base year for Nitrogen trifluoride (NF3)	1990	2005	2005	2005		2005	Subject to accounting rules	N/A
			1990 for overall emission reduction target	1990 for overall emission reduction target					
Carry-over of units from preceding periods[2]	Subject to KP rules including those agreed in the Doha Amendment	No	EU ETS allowances can be banked into subsequent ETS trading periods since the second trading period.	No carry over from previous period.	Indefinite validity of allowances not limited to trading periods. No need to carry over.		No	No	No
Gases covered	CO_2, CH_4, N_2O, HFCs[3], PFCs, SF_6, NF_3	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, N_2O, PFCs,	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, CH_4, N_2O	CO_2, CH_4, N_2O, SF_6, NF_3, HFCs, PFCs
Sectors included	Energy, IPPU, agriculture, waste, LULUCF	Energy, IPPU, agriculture, waste, LULUCF	Power & heat generation, energy-intensive industry sectors, aviation	Transport (except aviation), buildings, non-ETS industry, agriculture and waste	Electricity & heat generation, energy-intensive industry, aviation[4], maritime[5]	Buildings, road transport and small-emitting sectors (i.e. emissions from fuel combustion in these sectors)	Domestic transport (except aviation), buildings, non-ETS industry, agriculture and waste	Land use, land use change and forestry	Economy-wide
Global Warming Potentials used	IPCC SAR / IPCC AR4	IPCC AR5	IPCC AR4		IPCC AR5				IPCC AR5
Applicable to number of MS	15 (additional KP targets for single MS) / EU-27, UK and Iceland	EU-27	EU-27[6]		EU-27[7]				EU-27[8]

1 Surrendering of allowances under the new ETS 2 will start in 2027.
2 For the CP2 it refers to carry over from CP1. For the ETS it refers to carry-over from previous trading period under the scheme itself. For the effort sharing legislation it refers to carry over from ESD to ESR. For LULUCF it refers to carry-over from Kyoto Protocol period.
3 HFCs are also covered by the Kigali Amendment to the Montreal Protocol, which entered into force on the 1st of January 2019.
4 Emissions from flights between EEA airports as well as flights departing to airports in Switzerland and in the UK.
5 Emissions from all large ships entering EU ports in respect of 50% of emissions from voyages starting or ending outside of the EU and 100% of emissions that occur between two EU ports and when ships are within EU ports.
6 In addition to the 27 Member States, Northern Ireland, Iceland, Liechtenstein and Norway are also covered under the EU-ETS. The UK was initially also covered by the ESD.
7 In addition to the 27 Member States, Northern Ireland, Iceland, Liechtenstein and Norway are also covered under the EU-ETS. Norway and Iceland have also incorporated the ESR.
8 Within the Agreement on the European Economic Area, Iceland and Norway cooperate with the EU-27 towards achieving the 2030 targets in the LULUCF and Effort Sharing sectors.

2. EU climate targets, estimaing the emissions falling under its scope (technical note)

2.1 Introduction

So far, the tracking of progress towards the **EU climate targets** (i.e. 2020, 2030), including the 2050 climate-neutrality objective, compared to 1990 emissions, has been based on the annual EU greenhouse gas (GHG) inventory submitted to the UNFCCC, using the total GHG emissions, net of removals (LULUCF), including, or excluding, emissions from international aviation (GHG inventory). However, none of these aggregates reflects the exact legal scope as provided by the **European Climate Law**[9]. Nor do those aggregates reflect the scope of the EU nationally determined contribution (NDC) as submitted to the UNFCCC secretariat.

This note first describes the 2050 climate-neutrality objective and the 2030 climate target set in the European Climate Law. Then it sets out the definition of an aggregate that more closely reflects their legal scope, and the methodology the Commission recommends for the estimation of the emissions since 1990. This refers, in particular, to the estimation of the emissions from international aviation and maritime transport currently covered by the EU law. The reason for this being that the scope of the EU ETS has evolved since it was created in 2005 with the inclusion of new countries, activities and gases. Therefore, it is necessary to produce estimates of historical emissions for aviation and maritime transport in line with the scope of the European Climate Law and consistent with the current scope of the EU ETS.

2.2 EU climate targets as defined in the European Climate Law

Article 2(1) of Regulation (EU) 2021/1119 (European Climate Law) provides that:

> *Union-wide greenhouse gas emissions and removals regulated in Union law shall be balanced within the Union at the latest by 2050, thus reducing emissions to net zero by that date, and the Union shall aim to achieve negative emissions thereafter.*

The 2050 objective is set at Union level, economy-wide, and is to be achieved domestically, without the use of international credits[10]. Which emissions and removals are regulated in Union law can change over time. There should be a territorial link with the Union, and the exact territorial scope is set by the acts that regulate the GHG emissions and removals.

Article 4(1) on intermediate EU climate targets provides that:

> *In order to reach the climate-neutrality objective set out in Article 2(1), the binding Union 2030 climate target shall be a domestic reduction of net greenhouse gas emissions (emissions after deduction of removals) by at least 55 % compared to 1990 levels by 2030.*

> *When implementing the target referred to in the first subparagraph, the relevant Union institutions and the Member States shall prioritise swift and predictable emission reductions and, at the same time, enhance removals by natural sinks.*

> *In order to ensure that sufficient mitigation efforts are deployed up to 2030, for the purpose of this Regulation and without prejudice to the review of Union legislation referred to in paragraph 2, the contribution of net removals to the Union 2030 climate target shall be limited to 225 million tonnes of CO_2 equivalent. In order to enhance the Union's carbon sink in line with the objective of achieving climate neutrality by 2050, the Union shall aim to achieve a higher volume of its net carbon sink in 2030.*

The 2030 climate target is a step on the way to achieving the 2050 climate-neutrality objective, and the scopes should be consistent. What is covered in the legislation enabling the achievement of the 2030 target is under the scope of the 2030 target (with the contribution of net removals to the 2030 EU climate target limited to 225 million tonnes of CO_2 equivalent).[11] It is a domestic reduction, meaning without using international credits, economy-wide, net, and covers the same GHG as the 2050 climate-neutrality objective (listed in Part 2 of Annex V to Regulation (EU) 2018/1999).

9 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1.

10 The following GHG are covered: Carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulphur hexafluoride (SF_6), Nitrogen trifluoride (NF_3), Hydrofluorocarbons (HFCs) (see list HFCs in Part 2 of Annex V to Regulation (EU) 2018/1999), Perfluorocarbons (PFCs) (see list PFCs in Part 2 of Annex V to Regulation (EU) 2018/1999). It includes GHG emissions and removals regulated in Union law.

11 According to recital 20 of the European Climate Law, "sinks include natural and technological solutions, as reported in the Union's greenhouse gas inventories to the UNFCCC". The GHG inventories allow for the reporting of "technological" sinks, referred to as "industrial carbon removals" in the CRCF. However, they are not covered by a specific policy instrument (notably they are not recognised under the ETS Directive, the ESR or the LULUCF Regulation) and so at this time are considered not regulated under Union Law with the purpose of meeting the 2030 climate target. The GHG inventory under the UNFCCC includes BECCS, based on IPCC guidelines but not DACCS. Note that there are currently no "industrial removals" to be reported in the GHG inventories, but that projects are being developed in some Member States which are expected to be operational in the coming years.

2.3 The EU target scope

Based on the above, the scope best representing the EU climate mitigation target, can be obtained adding to the EU-27 total domestic GHG emission, including LULUCF, the EU-27 emissions from international aviation and maritime transport regulated in Union Law. In particular and for the purpose of tracking the progress towards the EU climate target, EU emissions will cover:

International aviation (EU target scope): CO_2 emissions from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. International aviation also covers CO_2 emissions from non-domestic flights between EU Member States and the Outermost Regions (OMRs).[12]

By July 2026, the Commission will make a legislative proposal on the scope of the EU ETS for aviation. According to the revised EU ETS Directive[13], as a default from 1 January 2027, flights involving third countries not applying ICAO's CORSIA scheme will also be covered by the EU ETS, except for flights involving most small island countries and Least Developed Countries[14]. Flights to and from third countries applying ICAO's CORSIA scheme will continue not to be covered by the target scope. Consequently, the target scope will need to be adjusted accordingly.

Figure 2.1: Illustration of emissions from aviation covered by the EU target scope.

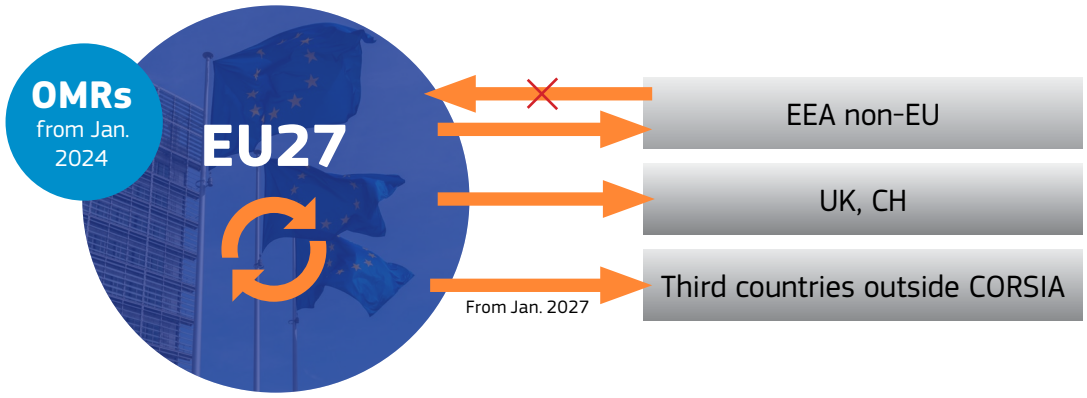


Table 2.1: Aviation emissions covered by the EU climate target.

Emissions	Domestic aviation			Intra-EEA aviation				Extra-EEA aviation
	Domestic EU flights (e.g. Palermo Milan)	Domestic "non-EU EEA" flights (e.g. Oslo to Bergen)	To OMRs (e.g. Canary Islands to Madrid)	Flights between "non-EU EEA" countries (from Oslo to Reykjavik)	Flights between "non-EU EEA" countries (from Oslo to Reykjavik)	Flights within the EEA, departing from EU airports	flights to/ from EU airports from/to OMRs	departing flights from EU airports to UK and Switzerland
EU 2030 target scope	Yes	No	No (covered by ESR)	No	No	Yes	From Jan 2024	Yes

12 From 1 January 2024, the revised EU ETS also covers non-domestic flights to and from outermost regions that were previously exempted. The outermost regions of the EEA Member Countries are: i) France: French Guiana, Guadeloupe, Martinique, Mayotte, Reunion, Saint Martin; ii) Spain: Canary Islands; iii) Portugal: Azores, Madeira.
13 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32023L0958
14 Article 25a(6) of Directive 2003/87/EC

International maritime transport (EU target scope): GHG emissions (i.e. CO_2 and from 2026 also CH_4, N_2O) from cargo and passenger ships of or above 5 000 GT as follows: i) 50% of emissions from voyages departing from a port outside the jurisdiction of an EU Member State and arriving at a port under the jurisdiction of an EU Member State; ii) 50% of emissions from voyages departing from a port under the jurisdiction of an EU Member State and arriving at a port outside the jurisdiction of an EU Member State; iii) 100% of emissions from voyages departing from a port under the jurisdiction of an EU Member State and arriving at a port under the jurisdiction of another EU Member State; iv) 100% of emissions within a port under the jurisdiction of an EU Member State.

Figure 2.2: Illustration of maritime transport covered by the EU target scope.

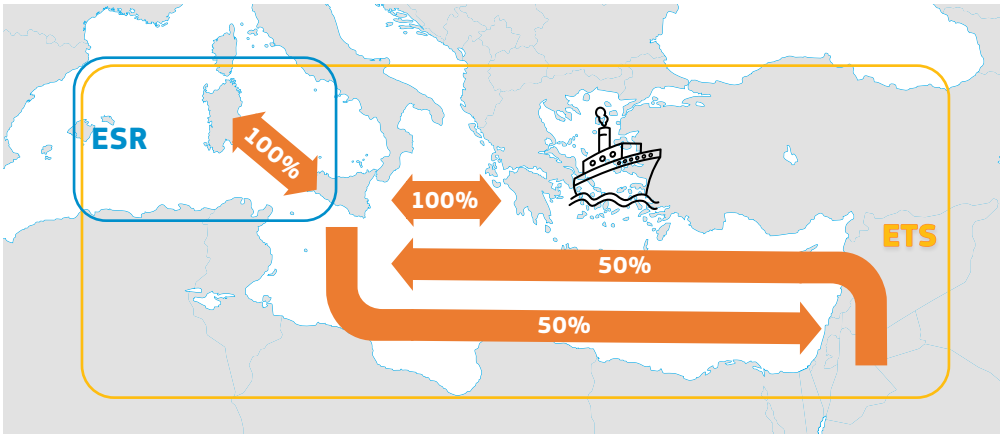


Table 2.2: Maritime emissions covered by the EU climate target and the EU NDC scope

Emissions	Domestic maritime transport		International maritime transport				At berth	
	Voyages within an EU MS (e.g. Valencia - Barcelona)	Voyages within NO/IS (e.g. Oslo - Bergen)	Voyages between two EU MS (e.g. Valencia - Rotterdam)	Voyages between an EU MS and NO/IS (e.g. Rotterdam - Oslo)	Voyages between an EU MS and a third country	Voyages between NO/IS and a third country (or IS/NO)	At berth emissions in a port of an EU MS	At berth emissions in a port of NO and IS, or of a third country
EU 2030 target scope	Yes	No	Yes	Yes 50%	Yes 50%	No	Yes	No

2.4 Methodology

International aviation and maritime emissions covered by the EU targets, as defined in the European Climate Law, are estimated by using the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES).[15] It allows to split the international transport CO_2 emissions into intraEU/extraEU and intraEEA/extraEEA categories backwards in time (i.e. 1990).[16]

For international transport, JRC-IDEES applies a decomposition methodology that reconciles the scopes of available primary statistics and harmonises historical data on international aviation and maritime emissions, energy use, and transport activity. The resulting annual dataset covers 1990-2021 and distinguishes domestic, intraEU/intraEEA, and extraEU/extraEEA activity for each EU Member State, Norway and Iceland.

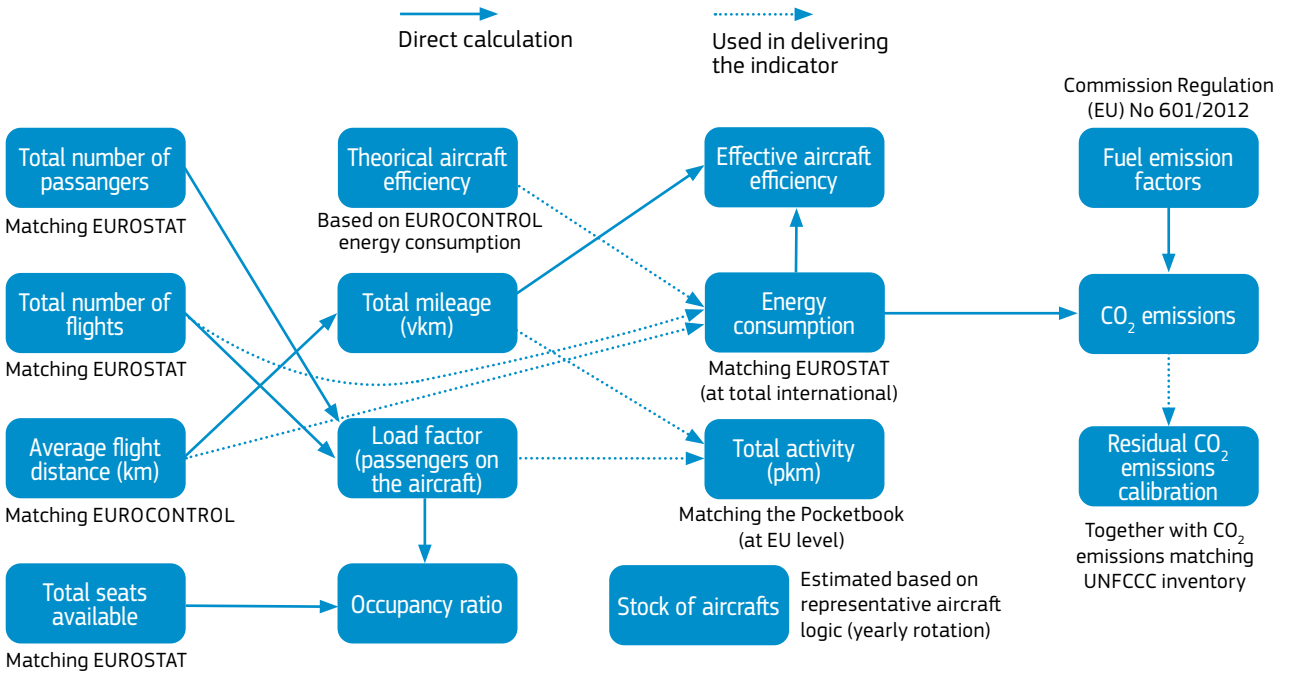
In aviation, JRC-IDEES distinguishes passenger and freight modes, with three geographical categories of flight origin/destinations for each mode: domestic, intra-EEA+UK, and extra-EEA+UK. Intra-EU, UK, and EEA categories are also used internally during calibration but aggregated for reporting. For each mode/category combination, JRC-IDEES estimates activity (as passenger-km or tonne-km), energy use and CO_2 emissions, aircraft stock (expressed as representative aircraft), load factors, and aircraft efficiencies. As country-specific activity statistics are not available, the decomposition first allocates EU-level activity data from the DG MOVE Transport Pocketbook[17] to each country and flight category.

15 European Commission, Joint Research Centre, Jaxa-Rozen, M., Rozsai, M. and Neuwahl, F., Aligning historical international aviation and maritime transport data to the scope of EU climate policies, Publications Office of the European Union, Luxembourg, JRC139028. https://publications.jrc.ec.europa.eu/repository/handle/JRC139028

16 The JRC-IDEES analytical database is designed to support energy modelling and policy analysis, by combining primary statistics with technical assumptions to compile detailed energy-economy-emissions historical data for each key energy sector. For aviation, EEA emissions includes emissions related to the UK but not to Switzerland, where total CO_2 emissions for the scope are additionally estimated from EUROCONTROL data.

17 https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2023_en

Figure 2.3: Aviation emissions: Overview of the methodology.



For passenger modes, this allocation calculates average load factors using Eurostat data on total passengers and flights. These load factors and total flight numbers are combined with average flight distances from EUROCONTROL to yield an initial estimate for passenger transport activity. For intra-EU activity, a uniform scaling factor is then applied across Member States to match total EU-level Transport Pocketbook data. Freight activity follows a similar process, using a "representative flight" concept with a common load factor across all Member States to account for mixed passenger-freight flights.

Next, the decomposition estimates fuel use from EUROCONTROL data, by deriving a distance-dependent average aircraft efficiency then applying it to the country-specific ensemble of flights and routes. The final step scales the estimates to meet Eurostat energy balances for total domestic and international consumption back to 1990 values, maintaining intra-EEA/extra-EEA fuel use ratios derived from EUROCONTROL. JRC-IDEES additionally reports resulting differences with UNFCCC country submissions. The above process is followed throughout the entire decomposition period (1990-2021). Data gaps are estimated from the existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average flight distance is kept constant for early years without EUROCONTROL data (generally before 2004).
- If the load factor (passengers per flight) cannot be calculated by lack of passenger and/or flight data, it is estimated from the trend of the existing time series.
- Missing numbers of flights are calculated from the load factor and the passengers carried.
- If no passenger data is available, the total mileage is estimated from the energy consumption, and combined with average flight distance to estimate the number of flights. The number of flights is then combined with the load factor to estimate the total passengers carried.
- For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) adjust the estimated fuel use to EUROCONTROL data for specific routes, and iii) scale this adjusted fuel use to Eurostat energy balances (e.g. before 1995 for Transport Pocketbook data; before 2004 for EUROCONTROL data).

For international maritime bunkers, JRC-IDEES estimates data both for intraEU/extraEU and intraEEA/extraEEA geographical categories. For the purpose of the present exercise, the emission estimates already include CO_2, CH_4, and N_2O gases. Transport activity (tonne-km) is estimated from Eurostat data on gross weight of transported goods, using port-level and country-level data for intra-EU and extra-EU categories, respectively. Intra-EU activities are then scaled to match the DG MOVE Transport Pocketbook totals, accounting for domestic coastal shipping (calibrated separately in JRC-IDEES). Next, transport activity is combined with THETIS MRV EU-level mileage data and country-specific vessel sizes to estimate load factors (tonne per movement). The load factors and resulting annual mileage (km) are calibrated to meet EU-level THETIS MRV mileage. The annual mileage is in turn combined with THETIS MRV average efficiency to yield a total technical energy consumption, with corresponding emissions derived from default

emissions factors. This energy consumption is scaled to Eurostat energy balances so as to minimize discrepancy to total intra-EU THETIS MRV emissions. As with aviation, JRC-IDEES reports corresponding differences to UNFCCC submissions. Early years with data gaps are estimated from existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average distance of voyages is kept constant for early years without Eurostat activity data (generally before 1997-2000).
- If the load factor (tonnes per movement) cannot be estimated by lack of activity data, it is kept constant.
- If activity data is not available, it is estimated from Eurostat energy consumption.
- Missing mileage data is derived from the activity and load factor estimates.
- For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) scale estimated mileage to meet EU-level THETIS MRV mileage, and iii) scale domestic and intra-EU CO_2 emissions estimated from energy consumption so as to match total THETIS MRV CO_2 emissions.
- Finally, the ratios between the estimated MRV emissions and the CO_2 emissions for the reported transport activity (for intra-EU/EEA and extra-EU/EEA categories) between 2018 and 2021 are used to calculate the MRV compliant estimates back to 1990 levels.

For the year 2022 and 2023, the international maritime and aviation emissions under the EU target scope have been estimated by applying the same share of those emissions on the total international maritime and aviation emissions (GHG inventory) as reported in 2021.

2.5 Emission estimates

Figure 2.4: EU-27 GHG international aviation and maritime transport under the EU target scope (1990-2023), Commission's estimates.

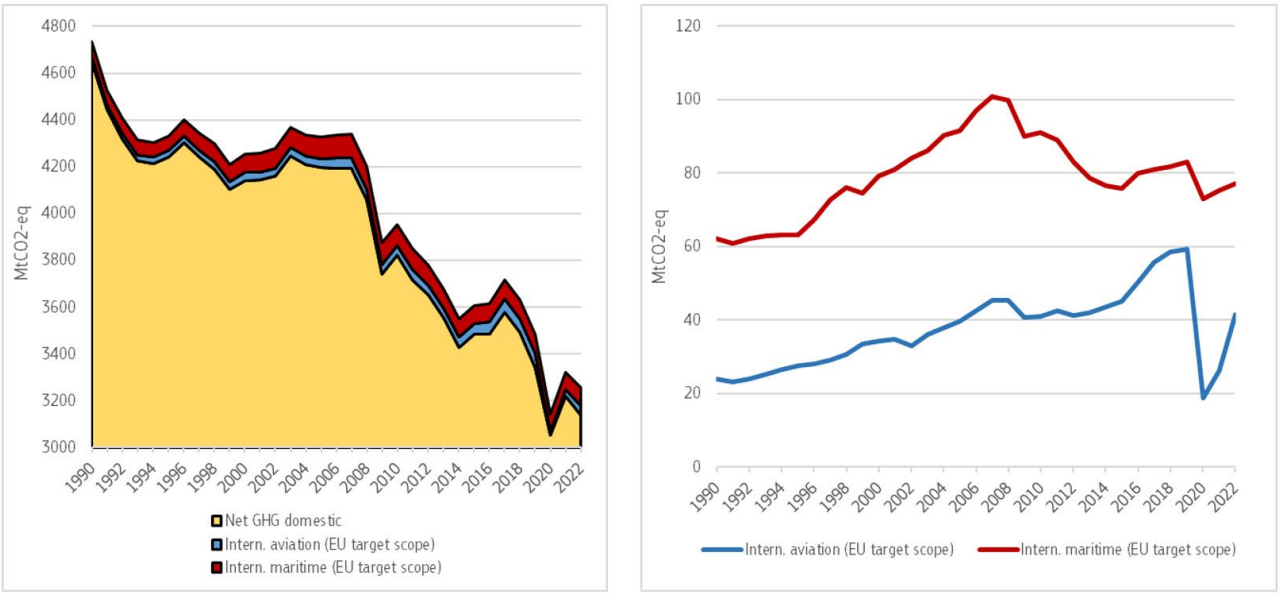


Table 2.3: EU-27 GHG emissions under the EU target scope (1990-2023), Commission's estimates.

EU-27	Source	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023 (proxy)
Total emissions (UNFCCC)	EEA GHG 2023	4867	4459	4453	4544	4172	3811	3293	3461	3375	3125
4 - Land Use, Land-Use Change and Forestry	EEA GHG 2023	-217	-317	-311	-348	-351	-325	-241	-241	-236	-257
Net GHG domestic emissions	EEA GHG 2024	4650	4241	4142	4196	3820	3486	3052	3220	3138	2869
Intern. aviation under the EU climate target scope	JRC-IDEES-2024	24	28	34	40	41	45	19	26	41	45
Intern. navigation under the EU climate target scope	JRC-IDEES-2024	62	63	79	92	91	76	73	75	77	72
Intra-EU navigation (MRV compliant, NDC scope*)	JRC-IDEES-2024	26	28	35	37	38	31	30	30	31	29
Net GHG emissions (target scope)	own calculation	4736	4332	4255	4327	3953	3607	3144	3322	3257	2987
Net GHG emissions (NDC scope)	own calculation	4700	4296	4212	4272	3899	3562	3100	3277	3211	2944

Note: i) Target scope includes: for Internation aviation intra-EU flights, departing flights from EU27 to EEA (non-EU) countries, to UK and to CH; for International maritime: emissions from voyages between two EU27 Member States, 50% of emissions from voyages between a EU27 Member State and NO/IS, 50% of emissions from voyages between an EU27 Member States and a third country. ii) NDC scope includes: for International aviation as for the target scope; for International maritime, emissions from voyages within the EU27 Member States

Table 2.4: Reduction of net GHGs in 2023 compared to 1990.

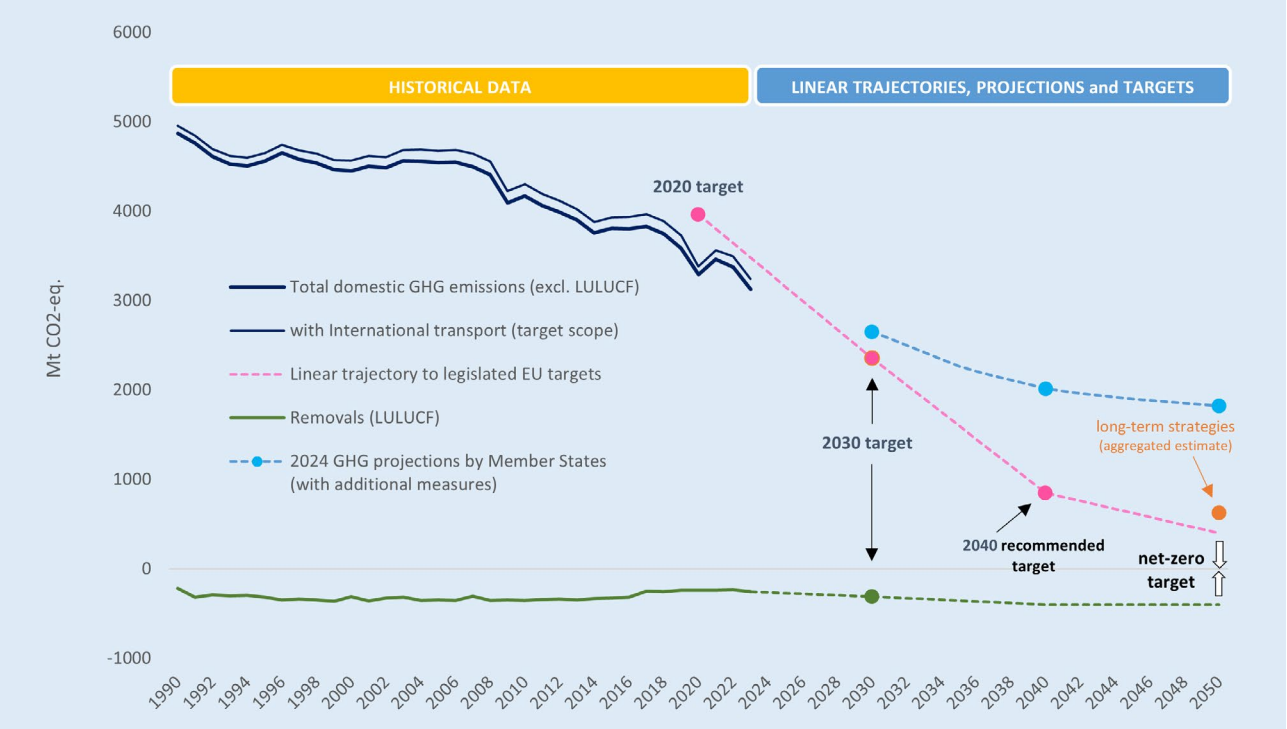
	1990	2023	2023/1990
Domestic	4650	2862	-38.4%
Target scope	4736	2980	-37.1%
NDC scope	4700	2937	-37.5%

3. EU's greenhouse gas emissions: trends and projections

3.1 EU greenshouse gas emissions and removals: recent developments

Preliminary EU GHG emissions in 2023 show a clear strong reduction compared with 2022, broadly in line with the linear declining trajectory towards the -55% EU 2030 reduction target (Figure .1). Total EU domestic GHG emissions (i.e. excluding LULUCF and international transport) decreased by 7.4% in 2023 compared with 2022. This translates into a reduction in GHG emissions of 35.8% compared with the 1990 base year (or 34.5% when international transport under the EU target scope is included)[18]. Over the same period, there is an approximated increase in reported GHG net removals from land use, land use change, and forestry (LULUCF) of around 20 million tonnes of CO_2 equivalent compared with 2022[19]. As a result, net GHG emissions for 2023 (i.e. including LULUCF) are expected to decrease by 8.6% compared with 2022 and to be 38.3% below the 1990 level (or 8.3% and 36.9%, respectively, when international transport under the EU target scope is included).

Figure 3.1: Total EU GHG emissions and removals (1990-2023), linear trajectories to EU targets, and Member States' latest GHG emissions projections (2023–2050)[20].



At Member State level, emissions in 2023 fell compared with 2022 in almost all Member States, with very large emission reductions in some. They went down by more than 20% in three Member States (-27% in Bulgaria, -26% in Sweden and -22% in Finland) and between 10% and 20% in five other Member States (-19% in Estonia, -16% in Latvia, -14% in Croatia, -12% in Greece and -10% in Germany). These falls were mainly driven by less electricity generated by fossil fuels in Bulgaria, Germany, Estonia and Greece, by the enhancement of LULUCF net removals in Finland and Latvia, by the emission reductions in industry in Sweden and in transport and waste in Croatia.

18 The EU GHG emission aggregate which better reflects the exact legal scope as provided by the European Climate Law can be obtained by adding to the EU-27 total domestic GHG emission, including LULUCF net emissions or removals, the EU-27 emissions from international aviation and maritime transport regulated in the Union Law. For more details, see Chapter 3 of the staff working document – 'Technical information'.

19 Approximated 2023 data could suggest a break to the declining trend in the LULUCF sink observed in recent years. However, the assessment takes into consideration the large uncertainty of these data and as it will possibly be subject to larger revisions.

20 Notes: (1) Historical GHG emissions and removals (1990-2023) are based on European Environment Agency's 2024 GHG Inventory and Approximated emissions and removals. (2) Linear trajectories for GHG emissions and removals (2023-2050) are based on the legislated EU 2030 targets, while emissions and removals by 2050 reflect estimates from the different model-based analyses supporting the "Delivering the European Green Deal". (3) The -55% 2030 target (EU Climate Law) considers a contribution of removals of -225 $MtCO_2eq$.

The GHG emission intensity of the economy, defined as the ratio between EU GHG net domestic emissions (i.e. including LULUCF net removals and excluding international maritime and aviation transport) and GDP, fell to 207 gCO_2-eq/EUR in 2023, close to a third of its (Figure 3.2.a), the steady decline in the GHG emission intensity was accompanied by a convergence among Member States. The similar pattern is shown by the GHG emissions per capita, reaching in 2023 a record low of 6.4 tonnes of CO_2 equivalent, although with a more gradual convergence among Member States (Figure 3.2.b).

Figure 3.2: GHG emission intensity of GDP and GHG emissions per capita (1995-2023)[21]

Figure 3.2.a

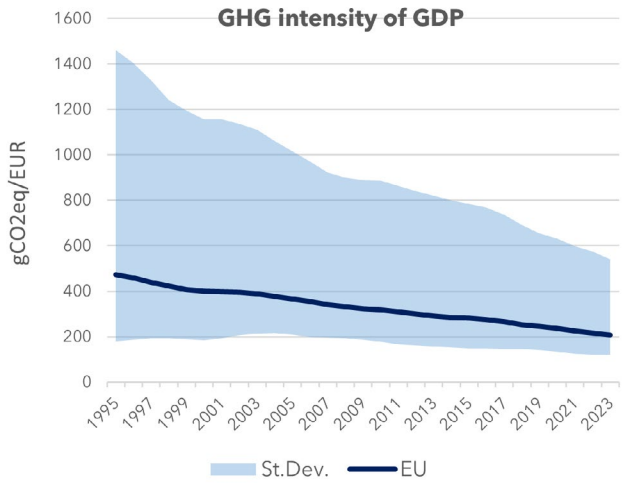
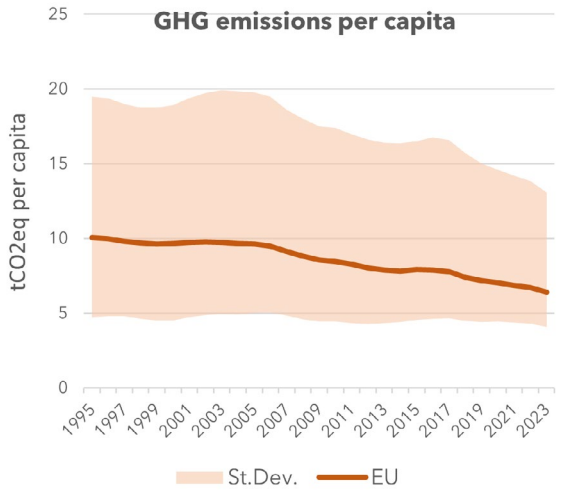


Figure 3.2.b



In terms of sectors, emission reductions in the last three decades were significant in the energy industry (-40%, or -18.6 $MtCO_2$eq per year on average, y-avg), in the fuel combustion in the manufacturing industry and construction (e.g. iron and steel production, -54%, or -2.7 $MtCO_2$eq/y-avg) and in the industrial processes and product use industries (e.g. chemical industry, -69% or -3.6 $MtCO_2$eq/y-avg; metal industry, -50%, or -2.2 $MtCO_2$eq/y-avg). Conversely, emissions in the transport sector have increased, especially in road transportation (+20%, or 4.2 $MtCO_2$eq/y-avg) although they have been slightly decreasing in the last ten years (see Table 3.1). Emission reduction in the agriculture sector (excluding fuel combustion) has somewhat halted at the half-way, somewhat plateauing since 2010.[22] Finally, the traditional role of natural sink of CO_2 of the LULUCF sector, declined at a worrying speed in the since 2010 (-33% or 10.4 $MtCO_2$eq of loss net removals per year on average).

Table 3.1: Change in EU's GHG emissions over 1990-2022 and expected change by 2030[23]

EU-27	1990	2010				2022				2030	
		Compared to 1990				Compared to 1990		Compared to 2010		Compared to 2022	
	$MtCO_2$eq	$MtCO_2$eq	%△	annual μ△ $MtCO_2$eq	$MtCO_2$eq	%△	annual μ△ $MtCO_2$eq	%△	annual μ△ $MtCO_2$eq	%△	annual μ△ $MtCO_2$eq
1 - Energy	**3741**	**3290**	**-12%**	**-22.5**	**2604**	**-30%**	**-36.7**	**-21%**	**-62.4**	**-40%**	**-115.9**
1.A.1 - Energy Industries of which	**1442**	**1255**	**-13%**	**-9.3**	**867**	**-40%**	**-18.6**	**-31%**	**-35.3**	**-44%**	**-41.9**
1.A.1.a - Public Electricity and Heat Production	1233	1084	-7.4	738	-40%	-16.0	-32%	-31.5			
1.A.2 - Manufacturing Industries and Construction of which	**721**	**471**	**-35%**	**-12.5**	**393**	**-46%**	**-10.6**	**-17%**	**-7.1**	**-39%**	**-17.2**
1.A.2.a - Iron and Steel	152	93	-39%	-2.9	70	-54%	-2.7	-26%	2.2		
1.A.2.c - Chemicals	95	67	-30%	-1.4	53	-44%	-1.3	-20%	-1.2		
1.A.2.f - Non-metallic minerals	129	100	-22%	-1.4	82	-37%	-1.5	-19%	-1.7		
1.A.3 - Transport of which	**672**	**812**	**21%**	**7.1**	**803**	**20%**	**4.2**	**-1%**	**-1.1**	**-27%**	**-24.4**
1.A.3.b - Road Transportation	620	768	24%	7.4	764	23%	4.6	-1%	-0.4		
1.A.4 - Other Sectors	**714**	**652**	**-9%**	**-3.1**	**475**	**-33%**	**-7.7**	**-27%**	**-16.1**	**-47%**	**-24.9**
1.A.4.a - Commercial/Institutional	172	159	-8%	-0.7	106	-38%	-2.1	-33%	-4.8		
1.A.4.b - Residential	450	412	-9%	-1.9	294	-35%	-5.0	-28%	-10.6		
1.A.4.c - Agriculture/Forestry/Fishing	92	81	-11%	-0.5	75	-19%	-0.6	-8%	-0.6		
2 - Industrial Processes and Product Use	**451**	**365**	**-19%**	**-4.3**	**292**	**-35%**	**-5.1**	**-20%**	**-6.6**	**-11%**	**-3.7**
2.A - Mineral Industry	**134**	**110**	**-18%**	**-1.2**	**99**	**-26%**	**-1.1**	**-10%**	**-1.0**		

21 Source: EU GHG net emissions based on 2024 EU GHG inventory (EEA) and approximated EU GHG inventory for 2023 (EEA), Eurostat for the population [demo_pjan] and GDP at constant price (2015, [nama_10_gdp]). Shaded areas represent the standard deviation across the Member States.
22 https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-agriculture
23 Based on the 2024 GHG inventory data submitted by Member States. Ending values for 2030 based on the model results under the MIX policy scenarios for delivering the European Green Deal https://energy.ec.europa.eu/data-and-analysis/energy-modelling/policy-scenarios-delivering-european-green-deal_en. The last two lines refer to the EU GHG emission aggregate which better reflects the exact legal scope as provided by the European Climate Law. For more details, see Chapter 3 of the staff working document – 'Technical information'.

2.B - Chemical Industry	162	77	-53%	-4.2	50	-69%	-3.6	-34%	-2.4		
2.C - Metal Industry	134	78	-42%	-2.8	66	-50%	-2.2	-15%	-1.1		
2.D,E,F,G,H - Other production	21	100	376%	3.9	76	262%	1.8	-2.4%	-2.2		
3 - Agriculture	**483**	**375**	**-22%**	**-5.4**	**366**	**-24%**	**-3.8**	**-2%**	**-0.8**	**-1%**	**-0.5**
of which											
3.1 - Livestock	317	249	22%	-3.4	243	-23%	-2.4	-2%	-0.5		
4 - Land Use, Land-Use Change and Forestry	**-217**	**-351**	**62%**	**-6.7**	**-236**	**9%**	**-0.6**	**-33%**	**10.4**	**31%**	**-8.2**
5 - Waste management	**185**	**137**	**-26%**	**-2.4**	**110**	**-41%**	**-2.4**	**-20%**	**-2.5**	**-17%**	**-2.1**
Total domestic GHG emissions (excluding LULUCF)	**4867**	**4172**	**-14%**	**-35**	**3375**	**-31%**	**-48**	**-19%**	**-72**	**-33%**	**-124**
Total domestic GHG net emissions (including LULUCF)	**4867**	**4172**	**-14%**	**-35**	**3375**	**-31%**	**-48**	**-19%**	**-72**	**-42%**	**-158**
Total GHG net emissions (EU target scope)	**4736**	**3953**	**-17%**	**-39**	**3257**	**-31%**	**-48**	**-18%**	**-63**	**-37%**	**-132**
Total GHG net emissions (NDC scope)	**4700**	**3899**	**-17%**	**-40**	**3211**	**-32%**	**-48**	**-18%**	**-63**	**-37%**	**-132**

Based on the analysis supporting the "Delivering the European Green Deal", in the years up to 2030 the speed of reduction needs to significantly accelerate almost in all sectors compared with the progress achieved since 2010, particularly in transport (i.e. from an average annual reduction of 1 since 2010 to 24 $MtCO_2eq$), fuel combustion in manufacturing (i.e. from 7 to 17 $MtCO_2eq$), and residential emissions (from 16 to 25 $MtCO_2eq$), while LULUCF need to reverse the last decade's trend in order to meet the EU -55% reduction target by 2030. In the case of agriculture, the GHG projected emission reductions, based on Member States reported existing and additional policies and measures (including under the new CAP 2023-2027) are in line with the Fit-for-55 package. Nevertheless, further efforts are needed, in particular to contribute to the increased ambition of the 2040 target.

3.2 Drivers of greenhouse gas emission reduction since 1990

A combination of factors has helped the EU to reduce total domestic greenhouse gas emissions (excluding the LULUCF sector) by about 31% over the past three decades. Figure 3.3 shows an annual breakdown of this trend into factors using a decomposition analysis with an extended Kaya identity[24]. The underlying methodology follows that of earlier studies, e.g. by the European Environment Agency[25]. As with all methods of this style, the effects should not be understood as an actual causality but rather a useful indication of the drivers' contribution.

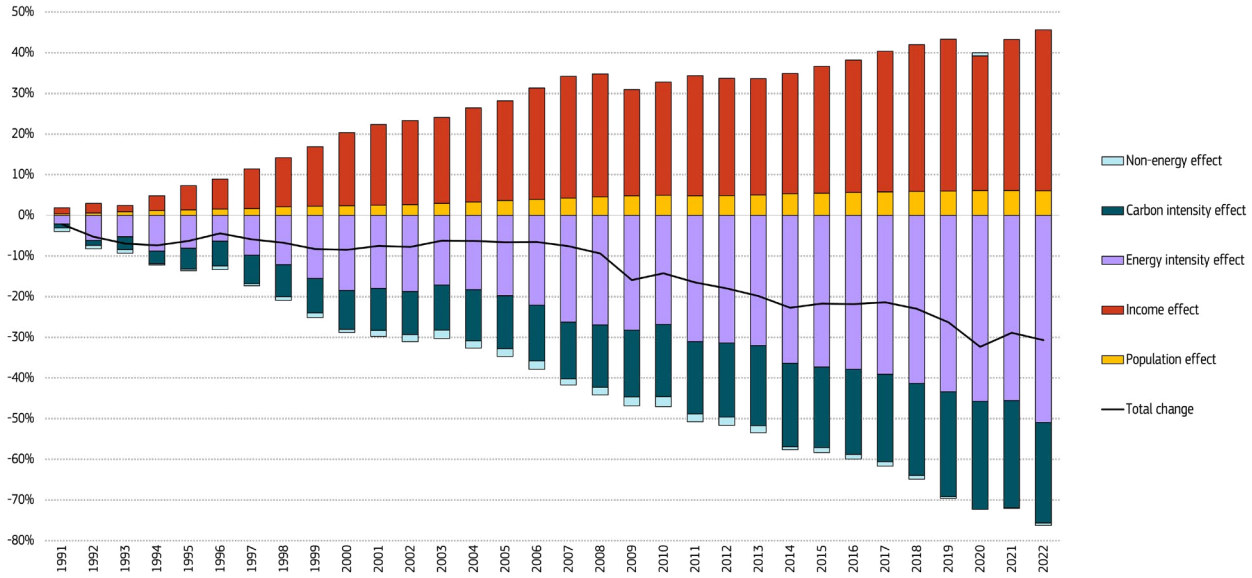
Without technological advances in energy efficiency and carbon intensity, i.e. holding all other factors at 1990 level, the growth in GDP (income effect) and population (population effect) would have led to a substantial increase in GHG emissions. Economic growth would have caused increase by 40% and population growth increase by 6 %.

However, just the emission reduction from the decrease in primary energy use per unit of output generated (energy intensity effect) more than compensated this and reduced emissions by 51%. Compared to 1990, 45% less energy was needed to produce a unit of GDP in 2022. There are several drivers behind this efficiency gain. Better energy transformation processes, for example through electrification, have happened. For example, emission intensity of metal production dropped by 15% only from 2017 to 2021, intensity of non-metallic mineral production dropped by 13% in the same period. There is also a general shift to the less energy-hungry sectors – for example the share of whole industry in total gross value added decreased by 14% from 1995 to 2021, moreover the share of energy intensive industry in manufacturing gross value added decreased by 17% in the same period.

The second important driver was the carbon intensity effect, i.e. the volume of emissions from one unit of produced energy, which taken individually, reduced emissions by 25%. The fuel switch plays a crucial role here. The share of solid fossil fuels in energy production decreased from 39% in 1990 to 17% in 2022, whereas the share of renewable and nuclear energy increased from 24% in 1990 to 55% in 2022.

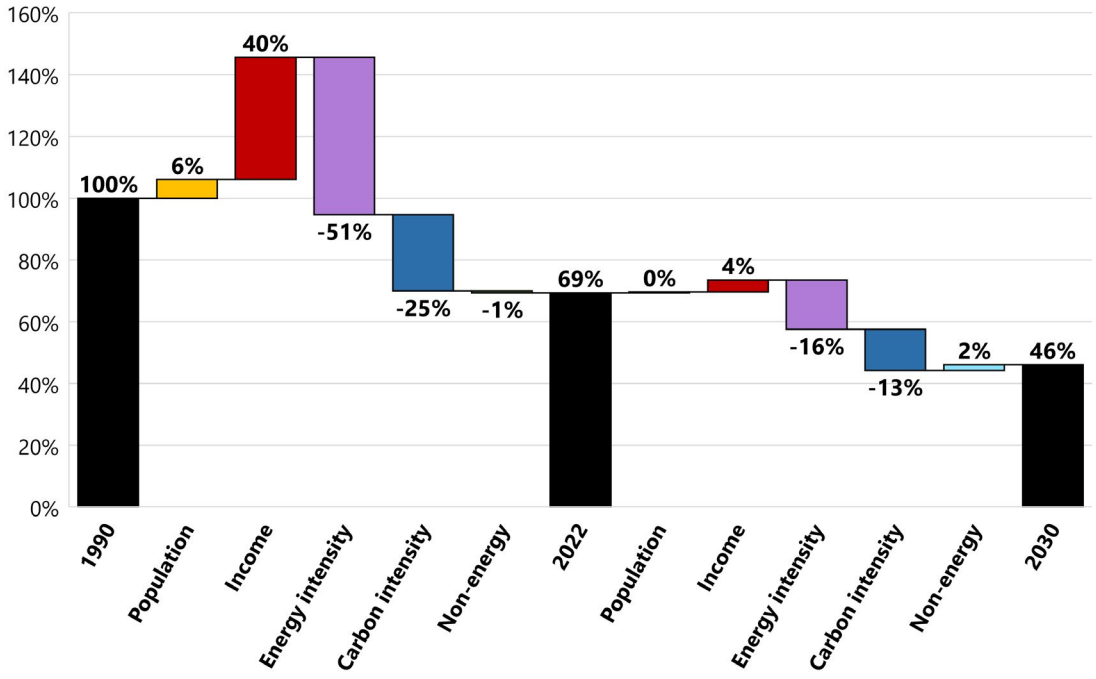
24 The Kaya identity is a mathematical identity stating that the total GHG emission level can be expressed as the product of four factors: human population, GDP per capita, energy intensity (per unit of GDP), and carbon intensity (emissions per unit of energy consumed).
25 The methodology of the Logarithm Mean Divisia Index (LMDI) method and the formula itself can be found in the EEA report No 03/2020 on trends and drivers of EU greenhouse gas emissions.

Figure 3.3: Drivers of total GHG emissions cumulated over 1990-2022[26]



To set these achievements into perspective, Figure 3.4 combines this assessment of past emission trends with a glance into the future. Based on the European Commission's central scenario supporting the Fit for 55 legislative package, a faster pace is needed in this decade to achieve the EU 2030 target. As in the last three decades, the modelling suggests the largest emission reductions will come from a substantially lower energy intensity (energy intensity should be lower by 25% in 2030) leading to decrease of total emissions by 16% and a less carbon-intense primary energy consumption (energy supply emissions should be lower by 21%) leading to decrease of total emissions by 13%. Overall, energy-related emissions are expected to decrease faster than those from other sources as implied by the slightly positive non-energy effect.

Figure 3.4: Effects on total GHG emissions between 1990-2022 and 2022-2030 based on the modelling for the 2030 target (in % of 1990 emissions)[27]



26 Data sources: EU inventories to the UNFCC, AMECO, Eurostat energy balances.
27 The remaining total emissions excluding LULUCF as shown in the chart is in line with EU's net emissions target of 57% mitigation.

3.3 Progress towards Climate Neutrality

In 2023, the Climate Action Progress Report[28] provided, for the first time, an assessment of progress under the European Climate Law[29] including the collective progress made by Member States towards the EU's goal to achieve climate-neutrality by 2050[30]. The assessment looked at progress on several aspects and from several sources, while taking into account the complexity inherent in the many possible paths to achieve a net-zero and resilient economy.[31]

Overall, the report concluded that the level of progress by Member States in recent years fell significantly short of the effort required over the coming decades to meet both the medium and the long-term EU climate targets. In particular based on the available information, the level of progress towards the EU climate-neutrality objective appeared insufficient for Poland, Ireland, Latvia, Malta, and Croatia, and, to a lesser extent, for Austria, Estonia, Czechia, Cyprus, Italy and Romania.

In December 2023, based on that assessment, the Commission issued county-specific recommendations[32] to the above Member States, with the exception of Romania, which in the meantime had updated their GHG projections in the context of the draft update NECP submission. The Commission urged Member States to rapidly accelerate action by making tangible progress on planned policies and by taking additional measures. Several Member States also faced sectoral weaknesses that needed to be remedied without further delay.

By end of September 2024, 7 of the 10 Member States concerned had notified the Commission on how they intend to address the recommendations. On 13 June, Latvia informed the Commission that in the context of the updated National Energy and Climate Plan (NECP) they will include increasing climate mitigation ambitions, supported by additional measures, and levered by new support funding mechanisms at EU level. In addition, Latvia will start updating its national long-term strategy, which will consider the Commission's recommendations to By end of September 2024, 7 of the 10 Member States concerned had notified the Commission on how they intend to address the recommendations. On 13 June, Latvia informed the Commission that in the context of the updated National Energy and Climate Plan (NECP) they will include increasing climate mitigation ambitions, supported increase the ambition and quality of the strategy, including on the critical role of LULUCF removals. On 18 June, Austria replied to the Commission listing recent measures taken by the government to mitigate climate change, including CO2 pricing introduced in October 2022 for all fossil fuel consumption outside EU ETS sectors, the environmental tax reform, several measures in the field of mobility, in renewables development, and to support a just transition. Austria also reiterated its objective to reach climate neutrality by 2040.On 4 September, Cyprus informed the Commission that that a new long-term low-emission development strategy is being prepared in the context of the finalisation of its National Energy and Climate Plan (NECP) update, without additional details. On 5 September, Ireland confirmed its support to the EU climate-neutrality goal. In its reply, Ireland referred to the Climate Action Plan 2024 and listed several concrete measures in the area of agriculture and LULUCF. On 20 September, Estonia informed the Commission that a new legislation, currently in preparation, will set in law GHG emission targets, providing clarity on how Estonia would reach climate neutrality by 2050. On 25 September, Malta signalled to the Commission that in May 2024 a new Climate Action Act was published providing for the set-up of an ad-hoc authority to focus on climate actions. Lastly, on 26 September, Czechia informed the Commission that the final updated NECP has addressed all the recommendation, including the consistency of Czechia's measures with the EU's climate-neutrality objective. In addition, Czechia has started to update its national long-term strategy. In a year's time, the Commission will reassess the situation based on the information included in the 2025 NECP progress report.

This section presents an update of the Climate-Neutrality Dashboard, a set of indicators used to examine past, present and future developments along multiple dimensions and across sectors. The aim is to ensure continuity in tracking progress towards the achievement of our common net-zero emissions objective, especially in this decisive decade for climate action. In order to improve our understanding of the underlying developments, the dashboard now includes the share of renewable on gross final energy consumption, in line with the renewable 2030 target. In addition, a set of seven new complementary indicators, or levers, is introduced to put some light into the level of GHG emissions in Member States (see Table 3.2). Each indicator characterises one sector – energy, industry, transport, buildings, waste, and agriculture, by looking, beyond emissions, at the critical driving forces or factors. The last indicator is cross-sectoral and shows investment effort. Averages for 2018-2022 are used for majority of indicators. Waste prevention and climate investment are using averages for 2017-2021, because data for 2022 were not available at the time of publication.

28 COM/2023/653 final
29 Articles 6 to 8 of the European Climate Law (EUR-Lex - 32021R1119 - EN - EUR-Lex (europa.eu)).
30 The EU climate-neutrality objective, set out in Article 2(1) of Regulation (EU) 2021/1119, is achieved when EU-wide GHG emissions and removals regulated in EU law are balanced within the EU at the latest by 2050, reducing emissions to net zero. The EU shall aim to achieve negative emissions thereafter.
31 The assessment was based on the detailed analysis provided in Chapter 5 of the staff working document – 'Technical information' (SWD(2023) 339 final).
32 Article 7(2) of the European Climate Law.

Table 3.2 Climate-Neutrality Dashboard, complementary indicators.

Indicator	Description	Source
Zero emission energy	The indicator presents the share of renewables and nuclear power in gross electricity and heat production. A high share indicates lower emissions, whereas a low share means dependency on fossil fuels (mainly coal and natural gas).	EEA. Greenhouse gas emissions by source sector (env_air_gge) EUROSTAT. Complete energy balances (nrg_bal_c)
Green industry	Electrification and utilisation of renewable energy is the path towards climate neutrality in manufacturing and construction. Thus, the share of these two in final energy consumption is shown by this indicator.	EUROSTAT. Complete energy balances (nrg_bal_c).
Sustainable mobility	Average CO_2 emissions of new cars sold indicate the share of electric and low-emission vehicles on the market and, thus, future emissions of the car fleet.	EUROSTAT. Average CO_2 emissions per km from new passenger cars (sdg_12_30).
Energy-efficient buildings	The final energy consumption of buildings per floor area is a telling indicator for the building sector. The indicator covers households as well as commercial and public service buildings. Energy consumption is also adjusted by the number of heating and cooling days.	EUROSTAT. Complete energy balances (nrg_bal_c). BSO. EU Building Stock Observatory. Available here. EUROSTAT. Cooling and heating degree days by country - annual data (nrg_chdd_a)
Waste prevention	Waste prevention sits at the top of the waste hierarchy as the most preferred way to reduce the environmental impacts of waste. This indicator shows municipal waste generation per capita as a key figure in the sector.	EUROSTAT. Municipal waste by waste management operations (env_wasmun)
Sustainable consumption	A large fraction of emissions in agriculture is due to bovine meat production and consumption. Consumption of this meat per capita is thus a good indication of sustainable consumer behaviour and potentially the country's emissions. Keep in mind that international trade also plays an important role here.	FAO. Food Balances. Available here. EUROSTAT. Usually resident population on 1 January (demo_urespop)
Climate investment	Climate-related investments as a share of gross domestic product (GDP) show efforts made across all sectors. The indicator includes private investment related to climate change mitigation (for example, renewable energy sources, electric vehicles or thermal insulation). It covers all steps in the value chain.	Investments in climate change mitigation by NACE Rev. 2 activity (env_ac_ccminv) - to be released soon

The values for **'zero emission energy'** in the power sector, range from 11% in Malta, 13% in Cyprus, 14% in Poland to 70% in Denmark, 86% in France, and 91% in Sweden. The indicator also shows an expected pattern. The higher the share of zero-emission energy, the lower the GHG intensity of the GDP the country has. Sweden is a top scorer – it has the lowest GHG intensity of its total GDP and the highest share of zero-emission energy in its power sector. Nevertheless, the correlation is not absolute, and there are some outliers[33].

The **greening industry** indicator has a similar pattern but a slightly weaker correlation. Values range from 24% in the Netherlands, 30% in Croatia, 31% in Romania up to 66% in Malta, 68% in Finland and 79% in Sweden. Again, Ireland and the Netherlands have a low share of green industry and low GHG intensity of GDP. The opposite case is in Greece, Estonia, and Latvia, which have a high share of green industry but high GHG intensity of GDP. Sweden is premiant once again.

33 The most obvious cases are Malta, Ireland, and the Netherlands, which have a low share of zero-emission energy and low GHG intensity of GDP. These countries can be economically productive without zero-emission energy, meaning that energy does not play an essential role in GDP generation.

On the **sustainable mobility**, markets with the lowest emissions of new car fleets are the Netherlands (average emissions 107 gCO_2/km), Sweden (112 gCO_2/km) and Denmark (113 gCO_2/km). On the opposite side are Latvia (147 gCO_2/km), Cyprus (148 gCO_2/km) and Estonia (150 gCO_2/km). Sustainable mobility has the strongest correlation between the indicator score and GHG intensity of the whole economy, with almost no significant outliers.

The lowest energy consumption of **buildings**[34] is in Finland (2.3 gCO_2/m^2), Bulgaria and Estonia (both 2.9 gCO_2/m^2). The most consuming buildings are in Luxembourg (7.8 gCO_2/m^2), Ireland (9.0 gCO_2/m^2) and Malta (10.2 gCO_2/m^2). There is almost no direct correlation between the indicator and GHG intensity, but it still shows interesting potential for reducing emissions through improved efficiency, including electrification, and behavioural change.

Waste prevention shows the potential for low value of emissions in the waste sector. The highest waste production is in Austria (835 kg/capita), Denmark (812 kg/capita) and Luxembourg (795 kg/capita). On the other hand, the lowest production is in Romania (283 kg), Poland (346 kg) and Estonia (388 kg). The correlation of this indicator and GHG intensity is strong and negative. It means that countries with low GHG intensity tends to have a higher volume of municipal waste. Sweden is a good example of country with low production of municipal waste and at the same time low GHG intensity of economy.

Bovine meat consumption is a proxy indicator for the whole agri-food patterns of each country. The highest consumption is in Luxembourg (31 kg/capita), Sweden and Portugal (both 22 kg/capita). The lowest consumption is in Poland (0.1 kg/capita), Bulgaria (4 kg/capita) and Romania (5 kg/capita). There is a strong negative correlation between bovine meat consumption and GHG intensity. Member States with low GHG intensity, such as Sweden, Denmark or Luxembourg, also have high bovine meat consumption. In contrast, countries with high GHG intensity, like Bulgaria or Poland, have the lowest bovine meat consumption. Please note that major net importers (such as Malta, Greece, and Portugal) have lower agricultural emissions than consumption of bovine meat indicates. On the other hand, emissions from net exporters (such as Ireland, Denmark, Poland, or Lithuania) also cover consumption in different countries.

Climate mitigation investment shows a negative correlation with GHG intensity. It indicates that Member States with low GHG intensity have already made substantial investments to achieve climate targets in the past, and Member States with high GHG intensity still need these investments. The lowest investment activity is in Ireland and Cyprus (both 0.1% of GDP), Luxembourg (0.2%). Denmark and Latvia (both 1.6%), and Lithuania (1.3%), show the highest investments. Denmark could be considered as a green investor – its GHG intensity is one of the lowest in the EU, but the investment rate is still the highest. Lithuania and Latvia are, on the other hand, countries with high GHG intensity but also high investment rates. We could expect a substantial decrease in GHG intensity in the future there. There are also some poor-performing countries in both metrics, such as Greece and Cyprus, where additional investments are needed.

Overall, the climate-neutrality dashboard shows that, compared with 2023 edition, around two third of the indicators have improved, while only a fifth have worsened. The most sizeable progress is in the historic part, due to the strong reduction in GHG net emissions in 2023. Progress towards medium- and long-term objective is mixed, partly due to the fact that less than half of Member States updated their GHG projections in 2024. Among the seven complementary indicators, the 'sustainable mobility' and the 'zero emissions energy' levers show the broadest improvement, while progress for the 'sustainable consumption' indicator is mixed.

At Member States level, across the different indicators, the dashboard highlights the most significant improvements for Estonia and Latvia, which in 2023 have received specific recommendations under the European Climate Law due their insufficient progress towards the Union's climate-neutrality objective, as well as for Finland and Bulgaria. Among the other Member States that received climate-neutrality recommendations in 2023, progress is noticeable also for Italy and Austria.

34 The values are controlled for the weather – the number of heating and cooling days in the country.

Table 3.3 Climate neutrality dashboard. Historical performance[35]

	Historic data[1]														
	Total net GHG emissions (% change)				Sector performance (2023-2015, contribution to change)							GHG intensity and GDP per capita[3]			
	2023-1990	2023-2022	2023-2019	2023-2015	Power	Industry	Transport	Buildings[2]	Agriculture	Waste	LULUCF	GHG intensity of GDP (2023)	GHG intensity of GDP (2023-2015, % change)	GHG emissions per capita (2023)	GHG emissions per capita (2023-2015, % change)
Austria	-5%	-7%	-23%	-12%	-4%	-2%	-4%	-3%	0%	-1%	2%	169	-20%	7.0	-17%
Belgium	-31%	-4%	-15%	-16%	-5%	-5%	-2%	-4%	0%	0%	0%	210	-26%	8.4	-20%
Bulgaria	-56%	-27%	-20%	-32%	-30%	1%	2%	-1%	0%	-1%	-3%	627	-45%	5.5	-26%
Croatia	-30%	-14%	-13%	-13%	-4%	0%	-1%	-1%	-3%	-9%	4%	304	-33%	4.7	-5%
Cyprus	57%	0%	-1%	6%	1%	2%	1%	0%	1%	1%	0%	330	-26%	9.2	-3%
Czechia	-45%	-13%	-20%	-14%	-19%	0%	3%	-1%	-1%	0%	4%	527	-26%	9.7	-17%
Denmark	-50%	-6%	-16%	-21%	-12%	-3%	-2%	-3%	-1%	0%	-1%	119	-35%	6.6	-25%
Estonia	-67%	-19%	-35%	-38%	-33%	-3%	2%	-1%	1%	0%	-3%	466	-49%	8.5	-40%
Finland	-18%	-22%	-21%	-6%	-20%	-6%	-3%	-3%	-1%	-2%	28%	170	-14%	7.1	-8%
France	-32%	-7%	-14%	-16%	-4%	-6%	-2%	-5%	-2%	0%	4%	146	-23%	5.2	-18%
Germany	-47%	-10%	-15%	-24%	-16%	-3%	-2%	-3%	-1%	0%	1%	204	-30%	8.0	-27%
Greece	-35%	-9%	-19%	-28%	-29%	-1%	1%	0%	0%	1%	-1%	339	-35%	6.3	-25%
Hungary	-48%	-9%	-19%	-15%	-9%	-3%	3%	-4%	-1%	0%	-1%	339	-32%	5.0	-13%
Ireland	1%	-6%	-7%	-7%	-6%	-1%	0%	-2%	-1%	0%	2%	138	-42%	11.5	-18%
Italy	-31%	-7%	-5%	-10%	-8%	-3%	0%	-4%	0%	0%	5%	201	-17%	6.1	-8%
Latvia	-8%	-16%	37%	13%	-7%	0%	0%	0%	0%	0%	20%	439	-3%	6.7	19%
Lithuania	-71%	-3%	-14%	1%	-7%	-10%	9%	1%	-4%	-3%	15%	259	-20%	4.3	3%
Luxembourg	-45%	-7%	-32%	-29%	-3%	-5%	-16%	-2%	0%	0%	-4%	110	-40%	10.6	-40%
Malta	-19%	-6%	0%	-1%	-4%	1%	5%	-5%	0%	2%	0%	137	-36%	3.9	-20%
Netherlands	-36%	-7%	-21%	-27%	-16%	-2%	-1%	-5%	-1%	-1%	-1%	177	-38%	8.2	-31%
Poland	-29%	-8%	-13%	-9%	-11%	-1%	7%	-3%	0%	0%	-1%	554	-32%	8.6	-6%
Portugal	-29%	-8%	-21%	-27%	-20%	-5%	3%	-1%	0%	0%	-4%	219	-38%	4.4	-28%
Romania	-74%	-7%	-14%	-14%	-18%	-6%	7%	0%	-1%	0%	3%	276	-35%	3.1	-10%
Slovakia	-55%	-2%	-17%	-18%	-6%	-6%	2%	-1%	0%	0%	-7%	309	-30%	5.4	-18%
Slovenia	0%	-6%	-12%	-17%	-7%	-1%	0%	-2%	0%	-1%	-4%	295	-34%	6.8	-19%
Spain	-10%	-8%	-13%	-20%	-16%	-6%	2%	0%	0%	0%	0%	187	-30%	4.7	-23%
Sweden	-85%	-26%	-69%	201%	-115%	-180%	-473%	-76%	-12%	-59%	1114%	6	162%	0.3	178%
EU27	-38%	-9%	-14%	-18%	-13%	-3%	0%	-3%	-1%	0%	2%	206	-28%	6.4	-19%

35 Note to the table: (1) Historical GHG emissions and removals (1990-2022) are based on EEA's 2023 GHG Inventory and Approximated emissions and removals. (2) Including agriculture CO_2 emissions. (3) GHG intensity of GDP (gCO_2-eq/EUR2015) and GHG per capita (tCO_2-eq) use net GHG emissions (i.e. including LULUCF and excluding international aviation). Real GDP and population data from Eurostat.

Table 3.4 : Climate-neutrality dashboard – levers and projections[36]

	GHG emission projections, levers, and future challenges[4]															
	2030 objectives and projections				Climate-neutrality levers							Climate-neutrality objectives and projections[5]				
	MS projected net GHG by 2030 (tonnes of CO2 eq. per capita)	ESR target vs MS projections (to 2005 level, ppt)	LULUCF target vs MS projections (tCO2eq/Km² of land)	Share of gross final consumption of energy from **renewable** sources	**Zero-Emission Energy** (share of RES and nuclear in gross electricity and heat production)	**Greening Industry** (share of RES and electricity in FEC in manufacturing and construction)	**Sustainable mobility** (average CO2 emissions of new cars sold)	**Energy efficient buildings** (FEC in buildings, g0E per m2*HDD and CDD)	**Waste prevention** (municipal waste generation per capita, kg)	**Climate investment** (climate change mitigation purposes, as share of GDP)	**Sustainable consumption** (bovine meet consumption per capita, kg)	MS projected net GHG by 2050 (tonnes of CO2 eq. per capita)	Overshoot vs. linear trajectory net GHG emissions 2023-2050	Overshoot vs. Benchmark Total GHG emissions 2023-2050	Target year for climate neutrality (NECPR, nLTS or other sources)	Legal Status of long term target (based on https://zerotracker.net/)
Austria	5.3	-6	1	34%	68%	48%	133	3.7	835	1.0%	14	2.3	21%	19%	2040	In law
Belgium	6.8	-4	-4	14%	62%	38%	129	4.9	742	1.4%	12	3.1	53%	21%	2050	In policy document
Bulgaria	5.9	-12	-3	19%	48%	38%	146	2.9	427	0.7%	4	3.6	26%	66%	2050	Declaration / pledge
Croatia	5.2	0	-92	29%	58%	29%	135	5.0	432	1.4%	15	3.4	63%	71%	2050	In policy document
Cyprus	6.7	-23	41	19%	13%	36%	148	3.4	649	0.3%	12	3.7	31%	56%	2050	In policy document
Czechia	7.5	-6	-32	18%	37%	39%	146	5.7	519	1.0%	11	4.3	13%	33%	2030	In policy document
Denmark	4.2	-6	140	42%	70%	42%	113	3.6	812	2.3%	22	2.8	14%	3%	2050	Declaration / pledge
Estonia	7.7	-10	-100	38%	46%	51%	150	2.9	388	1.5%	9	3.3	29%	46%	2050	Declaration / pledge
Finland	0.8	-4	13	48%	69%	68%	117	2.3	573	0.9%	17	-2.3	-101%	-10%	2035	In law
France	4.6	-14	-25	20%	85%	42%	121	5.6	555	1.0%	22	3.6	64%	63%	2050	In law
Germany	5.3	-9	-99	21%	45%	39%	134	4.4	627	0.7%	14	1.8	-9%	-4%	2045	In law
Greece	5.6	13	5	23%	36%	48%	129	3.6	510	0.3%	15	5.6	55%	70%	2050	In law
Hungary	5.4	-6	-27	15%	50%	40%	144	6.3	394	1.4%	6	4.4	87%	66%	2050	In law
Ireland	8.9	-17	-24	13%	38%	35%	124	9.0	644	0.1%	19	6.4	48%	35%	2050	In law
Italy	4.5	-3	-37	19%	36%	42%	131	5.0	494	0.4%	16	3.5	32%	52%	2050	In policy document
Latvia	6.6	-2	-67	43%	58%	67%	147	4.8	439	1.7%	6	5.6	33%	8%	2050	In policy document
Lithuania	2.5	0	53	30%	57%	42%	147	4.6	471	2.2%	6	2.8	21%	30%	2050	In policy document
Luxembourg	7.0	6	12	14%	52%	45%	141	7.8	795	0.4%	31	0.8	-6%	-4%	2050	In law
Malta	4.2	-65	-46	13%	11%	63%	118	10.2	658	0.3%	19	3.9	142%	111%	2050	In policy document
Netherlands	6.8	-9	37	15%	28%	25%	107	5.6	516	0.5%	17	4.8	53%	38%	2050	In law
Poland	9.1	-11	-118	17%	14%	40%	147	5.4	346	0.9%	0	8.0	84%	78%	2030	In policy document
Portugal	2.8	13	139	35%	51%	54%	118	4.3	506	0.5%	22	0.3	-18%	22%	2050	In law
Romania	3.3	-17	62	24%	49%	31%	136	6.2	283	1.3%	5	3.5	103%	77%	2050	In policy document
Slovakia	5.2	-11	-42	18%	66%	40%	146	5.3	438	0.9%	7	3.8	82%	62%	2050	In law
Slovenia	5.2	-1	117	25%	62%	47%	140	5.2	492	0.7%	12	0.0	-1%	12%	2050	In policy document
Spain	3.2	7	-15	22%	62%	43%	135	3.2	467	0.4%	13	2.8	31%	47%	2050	In law
Sweden	-0.4	-6	-18	66%	91%	79%	112	3.0	425	1.3%	22	-1.3	-473%	27%	2045	In law
EU27 (MS aggr. proj.)	5.0	-6	-22	23%	55%	43%	130	3.9	511	0.8%	14	3.3	32%	39%	2050	In law

36 Note to table: (4) GHG emission projections submitted in 2023 and updated in 2024 by Member States under Art. 18 of the Governance Regulation considering additional measures (WAM). EU Population in 2050 is based on the latest Eurostat population projections. Agriculture and forest land are based on the Eurostat land use statistics. (5) The overshoot vs. a linear trajectory compares, for each Member State, the cumulative projected net GHG emissions (including LULUCF) between 2022 and 2050 with a linear trajectory starting from the 2022 emission level to zero by 2050. The overshoot against an indicative benchmark compares the cumulative projected GHG emissions (excluding LULUCF) with an indicative pathway to climate neutrality based on the scenarios proposed by the European Scientific Advisory Board on Climate Change, and then distributed across Member States according to the country's share of EU emissions in the core policy scenario supporting the initiatives delivering the European Green Deal. Target dates to achieve climate neutrality as for the national long-term strategies, the NECP progress reports or, in grey, from other unofficial sources (Net Zero Tracker).

3.4 Additional greenhouse gases indicators

Since 2005, there has been a clear decline in GHG intensity of GDP, and similar but to a lesser extent, in net GHG emissions per capita for all EU Member States, except for Latvia[37] (.a and Figure 3.5.b)[38].

Countries with higher emission intensity of GDP ratios in 2005 (e.g. Bulgaria, Poland, Czechia, Romania, Estonia, and Slovakia) experienced the most significant reductions, leading to a convergence towards the EU average. Figure 3.5.b show a similar patter for the emissions per capita rates, with a sizable group of countries with emissions above 10 tonnes of CO_2 equivalent per capita in 2005, moving closer to the EU average of 6 tCO_2-eq in 2023. Nonetheless, in 2023, Poland and Czechia ranked among the top five for the two indicators, while Bulgaria showed the highest GHG intensity of GDP (above 620 grammes of CO_2 equivalent per Euro of GDP), and Ireland was the highest per capita emitter among the EU Member States (above 12 tonnes per capita).

Figure 3.5: Greenhouse gas emissions intensity (i.e. the ratio between GHG emissions and GDP, gCO_2-eq./ EUR2015) and greenhouse gas emissions per capita in the EU and its Member States in 2005 and changes to 2023[39]

Figure 3.5.a - a GHG intensity of GDP

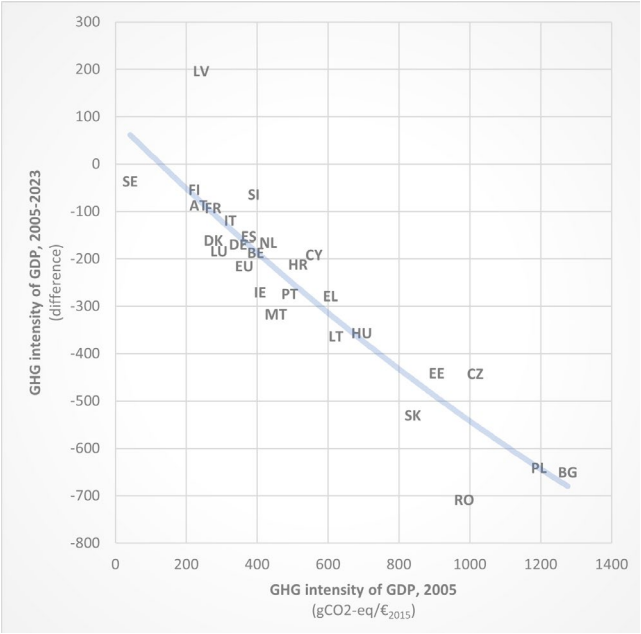
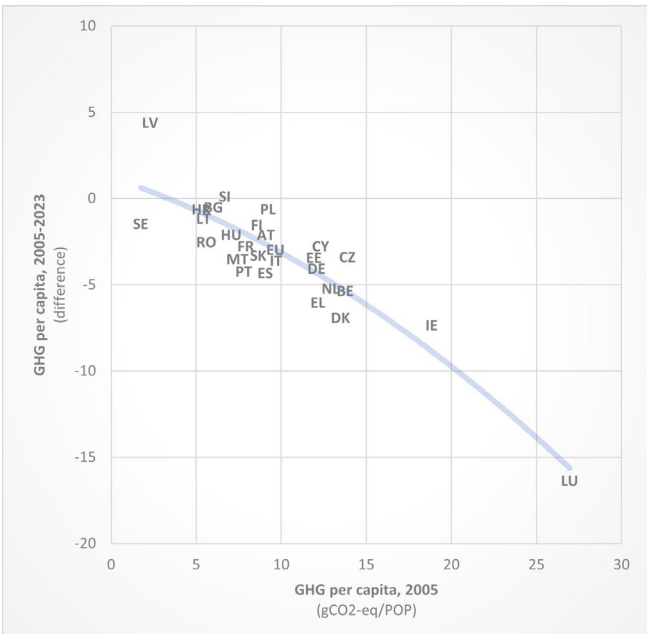


Figure 3.5.b - GHG per capita



37 Due to a declining LULUCF sink.
38 Figures use net GHG emissions, including LULUCF and excluding international transport emissions.
39 Source: EU GHG net emissions based on 2024 EU GHG inventory (EEA) and approximated EU GHG inventory for 2023 (EEA), Eurostat for the population [demo_pjan] and GDP at constant price (2015,[nama_10_gdp].

In 2023, domestic transport surpassed the energy supply as the largest contributor to total EU GHG emissions (24% versus 23%). Adding emissions from international aviation and maritime, bring the emissions from transport activities close to a third of the total EU emissions[40]. Transport and Energy are closely followed by the industry sector (19%) when the energy use in manufacturing industries (11%) and emissions from industrial process and use (8%) are taken together (Figure 3.6.b).

Figure 3.6: EU-27 greenhouse gas emissions by sector (1990-2023) and in % of total emissions (2023)[41]

Figure 3.6.a

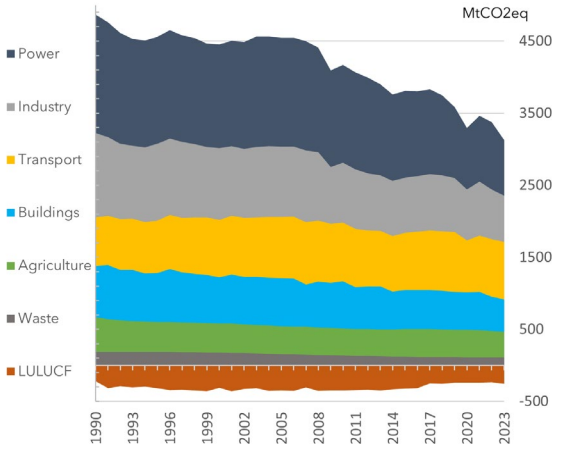


Figure 3.6.b

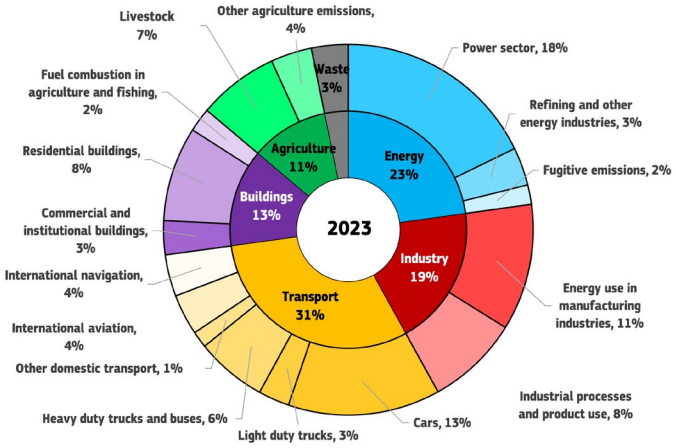


Figure 3.7: EU Member States greenhouse gas emissions by sector 2023 (in % of total emissions)[42]

Figure 3.7.a

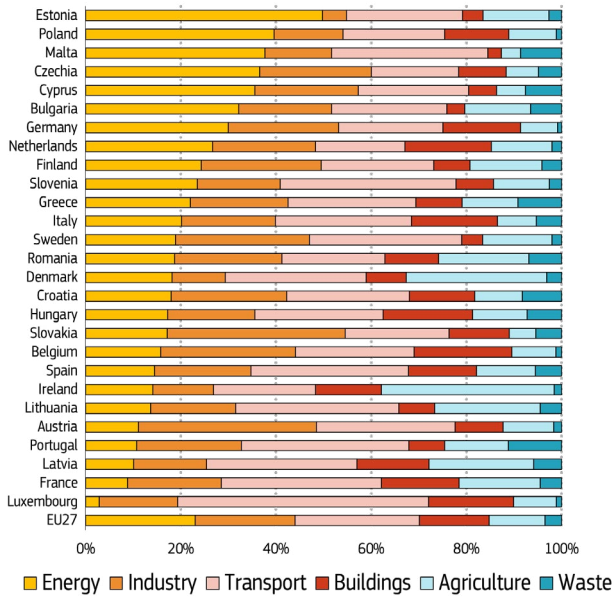
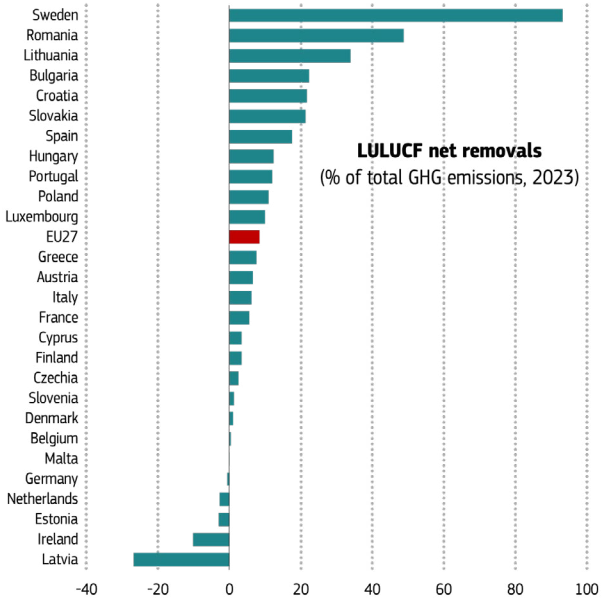


Figure 3.7.b



Among all the EU Member States, in 2023, GHG emissions from the energy sector were highest in Estonia (50% as a percentage of total GHG emissions), followed with some distance by Poland (40%) and Malta (38%) (Figure 3.7.a). Emissions from industry were relatively high in Slovakia and Austria (37%). The transport sector's contribution to GHG emissions stood out in Luxembourg (53%). Ireland and Denmark had the highest shares of GHG emissions from agriculture among all Member States (36% and 29%, respectively), followed by Lithuania and Latvia (22%). For Sweden, and with some distance also for Romania, the LULUCF sink was significant in relation to the countries' respective GHG emissions.

40 Emissions from international aviation and navigation as reported by Member States according to the UNFCCC GHG inventory (i.e. bunker approach). However, only around 50% of those emissions are currently estimated to be covered by the EU target (see Chapter 2)

41 The sectors used correspond to the following IPCC sectors: Energy: 1.A.1, 1.A.5, 1.B and 1.C; Energy use in manufacturing industries: 1.A.2: Industrial processes and product use: 2; Transport includes both domestic (1.A.3) and international (1.D.1, bunker approach); Buildings: 1.A.4, Agriculture: 3, Waste: 5. The sub-sectoral distribution within the Energy, Domestic Transport, Buildings and Agriculture sectors is based on the 2022 shares.

42 Industry includes both the Energy use in manufacturing industries: 1.A.2 and Industrial processes and product use: 2; Buildings includes CO_2 emissions in agriculture.

Table 3.5: Total GHG emission per Member States (including/excluding LULUCF and international transport)[43]

	Total GHG emissions, excl. LULUCF, excl. international transport					Total net GHG emissions, incl. LULUCF, excl. international transport					Total net GHG emissions, incl. LULUCF, incl. international transport				
	1990	2005	2015	2023	2023-1990	1990	2005	2015	2023	2023-1990	1990	2005	2015	2023	2023-1990
Belgium	146	145	119	99	-32%	143	144	118	99	-31%	159	173	142	129	-19%
Bulgaria	99	62	61	45	-54%	81	46	53	36	-56%	82	47	53	36	-56%
Czechia	201	150	130	108	-46%	192	142	122	105	-45%	193	143	123	106	-45%
Denmark	72	68	50	40	-45%	78	73	50	39	-50%	83	78	55	42	-50%
Germany	1251	988	899	674	-46%	1284	996	892	678	-47%	1303	1027	923	710	-46%
Estonia	40	19	18	11	-72%	35	16	19	12	-67%	36	17	20	13	-65%
Ireland	55	71	61	55	0%	60	77	66	61	1%	61	80	69	64	5%
Greece	104	137	96	71	-32%	102	133	92	66	-35%	113	145	101	77	-32%
Spain	287	438	333	276	-4%	253	392	287	228	-10%	270	429	326	271	0%
France	539	550	454	373	-31%	521	497	417	352	-32%	539	522	441	373	-31%
Croatia	32	31	26	23	-29%	26	23	21	18	-30%	26	23	21	19	-29%
Italy	522	596	443	384	-27%	519	562	401	360	-31%	527	577	415	376	-29%
Cyprus	6	9	8	9	58%	5	9	8	9	57%	6	11	10	10	62%
Latvia	26	11	11	10	-62%	14	5	11	13	-8%	15	6	12	13	-14%
Lithuania	48	22	20	18	-62%	43	18	12	12	-71%	43	19	13	13	-70%
Luxembourg	13	13	10	8	-39%	13	12	10	7	-45%	13	14	11	9	-33%
Hungary	95	77	62	54	-43%	92	71	56	48	-48%	92	72	57	49	-47%
Malta	3	3	2	2	-19%	3	3	2	2	-19%	4	5	7	10	166%
Netherlands	223	215	194	143	-36%	228	221	200	147	-36%	268	282	251	191	-29%
Austria	79	93	79	68	-14%	67	75	73	64	-5%	68	77	75	66	-3%
Poland	476	402	383	353	-26%	447	351	349	317	-29%	449	353	352	321	-29%
Portugal	59	86	68	53	-10%	66	90	64	47	-29%	69	93	69	53	-23%
Romania	257	151	117	105	-59%	230	120	68	59	-74%	231	120	69	59	-74%
Slovenia	19	21	17	15	-22%	14	13	17	14	0%	14	13	18	15	0%
Slovakia	73	51	41	37	-50%	65	46	36	29	-55%	65	47	36	29	-55%
Finland	71	70	55	41	-43%	48	45	42	39	-18%	51	48	45	42	-18%
Sweden	71	66	53	44	-38%	20	16	1	3	-85%	24	24	9	10	-56%
EU-27	**4867**	**4544**	**3811**	**3119**	**-36%**	**4650**	**4196**	**3486**	**2862**	**-38%**	**4807**	**4446**	**3721**	**3105**	**-35%**
EU-27 Net GHG emissions (EU target scope)											***4736***	***4327***	***3607***	***2980***	***-37%***
EU-27 Net GHG emissions (EU NDC scope)											***4700***	***4272***	***3562***	***2937***	***-38%***

43 The last two lines refer to the EU GHG emission aggregate which better reflects the exact legal scope as provided by the European Climate Law. For more details, see Chapter 2.

4. Tracking progress towards the EU's NDC setting its 2030 target under the UNFCCC enhanced transparency framework

With the Expert Review Team (ERT) conclusions that the EU and its Member State shall be deemed to have met their commitments under Article 3, paragraph 1 bis, of the Kyoto Protocol second commitment period; it is now time to move on to the implementation of the Enhanced Transparency Framework under the Paris Agreement.

The Enhanced Transparency Framework (ETF), adopted under the Paris Agreement, aims at building mutual trust and confidence and at promoting the effective implementation of the Agreement. It builds on the transparency arrangements under the United Nations Convention on Climate Change (UNFCCC), and its purpose is to provide a clear understanding of climate change action and of support provided and received. Information reported under the Enhanced Transparency Framework is of particular importance for the Global Stocktake, which periodically takes stock of the implementation of the Paris Agreement. The modalities, procedures and guidelines (MPGs) for the Enhanced Transparency Framework, adopted in decision 18/CMA.1 in 2018, specify the information which is to be provided by Parties in their Biennial Transparency Reports (BTRs). They also provide the rules for the technical expert review of this information and for the Facilitative, Multilateral Consideration of Progress (FMCP). Further details on the reporting of this information, including the outline of the BTR and tables for electronic reporting, were adopted in decision 5/CMA.3 in 2021. Tables for electronic reporting include Common Reporting Tables (CRT) for greenhouse gas inventory information and Common Tabular Formats (CTF). The latter are used for the reporting of information necessary to track progress in implementing and achieving Nationally Determined Contributions (NDCs), and information on support to developing countries. The first biennial transparency report, including CRT and CTF tables, is to be submitted by 31 December 2024 at the latest.

On 17th October 2023, the Council approved the submission of an updated nationally determined contribution (NDC) of the EU and its member states to the United Nations Framework Convention on Climate Change (UNFCCC). The EU and its MS raised their ambition to a greenhouse gas emissions reduction target of at least 55% by 2030 compared with 1990 levels.

The National Inventory Report is a key component of the BTR, as it will be the EU's indicator for tracking progress towards the NDC. The MPGs specify that this report may be submitted as a stand-alone report or as a component of the BTR. They also specify that the National Inventory Report (NIR) consists of a National Inventory Document (NID) and of the CRT. The outline for the National Inventory Documents is defined in decision 5/CMA.3, and it is similar to the outline for National Inventory Reports which are submitted by Parties listed in Annex I to the Convention. The EU will continue submitting its National Inventory Document as a standalone report, thus reporting separate reports.

The BTRs play a crucial role in tracking the progress made towards the 2030 target. To this end, the chapter on 'information necessary to track progress made in implementing and achieving the NDC' contains, inter alia, sections on the description of the NDC, on mitigation policies and measures, and on projections. The chapter on tracking progress is supplemented by CTF tables which contain details on policies and measures, on projections on GHG emissions and removals and on the Party's NDC. Moreover, this first BTR will also comprise information on national circumstances, institutional arrangements and NDC-specific data and indicators. There will be a strong focus as required under the Paris Agreement on the support provided to developing country parties for their implementation of the ETF. Under the MPGs parties are also invited to provide information on adaptation planning and actions.

The Governance Regulation article 29 paragraph 5(a) lays down the provisions to track progress and policy response to ensure Union targets achievement. This includes monitoring whether the Union and its Member States have made sufficient progress towards meeting their commitment taken under the Paris Agreement, towards their NDC.

5. Report on the quality of petrol and diesel fuel used for road transport in the European Union (reporting year 2022)

5.1 Introduction

Pursuant to Article 7a of Directive 98/70/EC[44] relating to the quality of petrol and diesel fuels (the "Fuel Quality Directive") and Article 5 of Council Directive (EU) 2015/652 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC[45], Member States are required to report annually on the GHG intensity of fuels and energy supplied in their territories. This reporting obligation applied for the first time tofor the 2017 reporting year, following the application and transposition of Council Directive (EU) 2015/652. The recent amendment of the Renewable Energy Directive[46], deleted Article 7a of the Fuel Quality Directive as from 20 November 2023. However, pursuant to Article 4 of the amending directive, which setout transitional provisions, Member States are still required to collect and report the data in accordance with Article 7a of the Fuel Quality Directive for the years 2022 and 2023. This annual report contains the data reported for the year 2022.

Furthermore and, pursuant to Article 8(3) of the Fuel Quality Directive, Member States are required to report on national fuel quality data for the preceding calendar year.

This annual report summarises the information provided by Member States in relation to the above-mentioned reporting requirements. It is based on the data submitted by Member States to the European Environment Agency (EEA) for the year 2022.

5.2 Volumes and life cycle greenhouse gas intensity of fuel and energy types

Article 7a of the Fuel Quality Directive set out, in conjunction with Council Directive (EU) 2015/652, set out reporting requirements concerning the following:

- the total volume of each type of fuel or energy supplied for road transport and non-road mobile machinery (including inland waterway vessels when not at sea), agricultural and forestry tractors, and recreational craft when not at sea;
- the life-cycle GHG emissions per unit of energy, including the provisional mean values of the estimated indirect land use change (ILUC) emissions from biofuels;[47]
- the feedstock and the biofuel production pathway used for each of the biofuels supplied on the territories of Member States.

Until the relevant articles are removed, the Fuel Quality Directive obliges Member States to require fuel suppliers to reduce the life-cycle GHG intensity of transport fuels, i.e., the life-cycle GHG emissions per unit of energy from fuel and energy supplied, by a minimum of 6% compared with the fuel baseline standard for 2010 of 94.1 gCO_2eq/MJ. ILUC GHG emissions are not taken into account when assessing compliance with the minimum 6% reduction target. The Renewable Energy Directive (EU) 2018/2001[48] sets out several measures to address ILUC including a cap on food- and feed-based biofuels. Its delegated act[49] sets out detailed criteria for determining high ILUC-risk feedstock for biofuels that are to be gradually phased out by 2030 and the criteria for certifying low ILUC-risk biofuels, bioliquids and biomass fuels.

In 2022, all 27 Member States, UK (in respect of Northern Ireland[50]), Iceland and Norway provided data on GHG emission reductions in the appropriate format. The comparisons between aggregated figures refer to the EU-27 for all reference years.

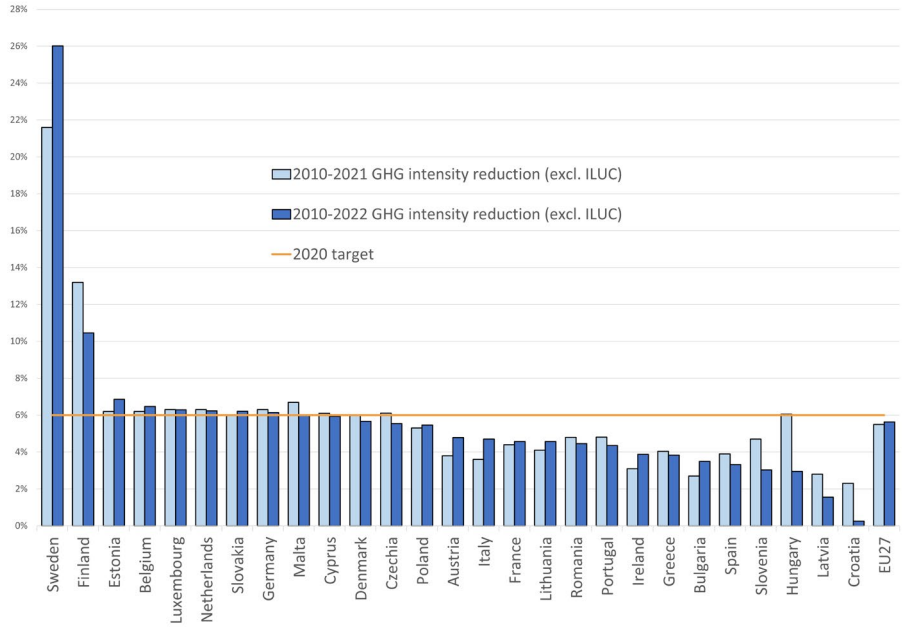
5.2.1 Greenhouse gas emissions and distance to 2020 target

According to the data provided, the average GHG intensity of the fuels and energy supplied in the 27 reporting Member States in 2022 was 89 gCO_2eq/MJ, which translates into a saving of 59 $MtCO_2eq$ during the year 2022. This is 5.6% lower than the 2010 baseline of 94.1 gCO_2eq/MJ (corresponding to a similar level of reduction achieved by the 27 EU Member States in 2021) and, means that an additional 0.4% reduction in the GHG intensity of all fossil fuels, biofuels and energy supplied is needed in order to reach the 6% target.

44 Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC, OJ L 350 of 28.12.1998, p. 58.
45 Council Directive (EU) 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels, OJ L 107 of 25.4.2015, p. 26.
46 Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.
47 Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources, OJ L239 of 15.9.2015, p. 8.
48 Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, OJ L 328, 21.12.2018, p. 82–209
49 Commission Delegated Regulation (EU) 2019/807 of 13 March 2019 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council as regards the determination of high indirect land-use change-risk feedstock for which a significant expansion of the production area into land with high carbon stock is observed and the certification of low indirect land-use change-risk biofuels, bioliquids and biomass fuels, OJ L 133, 21.5.2019, p. 1–7
50 Following the end of the transition period, Council Directive (EU) 2015/652 setting out relevant reporting obligations no longer applies to the UK as whole. However, pursuant to Article 5(4) read in conjunction with Annex 2, point 47 of the Protocol on Ireland/Northern Ireland to the Withdrawal Agreement (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12020W/TXT), Council Directive (EU) 2015/652 continues to apply to and in the UK in respect of Northern Ireland.

Reported data for 2022 shows that the progress achieved by EU fuel suppliers varies greatly across the EU Member States. 9 Member States (Sweden, Finland, Estonia, Belgium, Luxembourg, Netherlands, Slovakia, Germany and Malta) have achieved their objective of reducing the GHG intensity of transport fuels by 6% compared with 2010 (see Figure 5.1). The largest progress within a year was achieved by Sweden and Italy with 4.4 and 1.1 percentage points increases between 2021 and 2022, against the 2010 baseline, followed by Austria with 1.0 percentage point. However, most of the Member States made negative progress (14 Member States) or very minimal progress, i.e. below 1.0 percentage point (8 Member States), or remained at the same level (1 Member State). Further information can be found in the EEA Report on GHG intensities of transport fuels in the EU in 2022[51]

Figure 5.1: Reductions in GHG intensity of fuels achieved by EU fuel suppliers in Member States in 2010-2021 and 2010-2022 (Source: EEA)



Furthermore, in 2022, upstream emission reductions (UERs)[52] were reported by 15 Member States (Croatia, Malta, Slovenia, Luxembourg, Cyprus, Estonia, Slovakia, Czechia, Romania, Denmark, Hungary, Italy, Austria, Poland, Germany), which contributed between 0.4 and 3.7 percentage points to the overall GHG emission reduction achievement. Consequently, the total reported UERs were 5 927 kt CO_2eq in 2022, resulting in an additional reduction in the fuel GHG intensity by 0.5 percentage points from 5.1% to 5.6%. UERs claimed by suppliers have to be quantified and reported in accordance with the requirements set out in Council Directive (EU) 2015/652.

When ILUC emissions are taken into account[53], the average GHG intensity of the fuels in the EU in 2022 was 4.0% lower than in 2010. According to Article 7d of the Fuel Quality Directive, which lays down the method of calculation of life cycle GHG emissions from biofuels, ILUC emissions are not to be taken into account when assessing compliance with the minimum 6% reduction target.

Further action will be necessary in order to decarbonise the fuel used in transport and to contribute to the increased climate ambition, as set out in the European Green Deal and the legislative proposals adopted as part of the "Fit-For-55" legislative package of 14 July 2021. The amended Renewable Energy Directive substantially increases the overall ambition of decarbonising transport fuels and energy carriers. Member States will have to reduce their GHG intensity by at least 14.5% compared with the 2010 baseline or will need at least a 29% share of renewable energy within the final consumption of energy in the transport sector by 2030. In addititon, the ReFuelEU Aviation and FuelEU Maritime Regulations will boost the production and uptake of sustainable alternative fuels in the aviation and maritime sectors.

51 https://www.eionet.europa.eu/etcs/etc-cm/products/etc-cm-report-2024-04
52 'Upstream emissions' means all greenhouse gas emissions occurring prior to the raw material entering a refinery or a processing plant where the fuel is produced.
53 For this calculation, the provisional estimated indirect land-use change emissions from biofuels were taken into account as listed in Annex V of the Fuel Quality Directive.

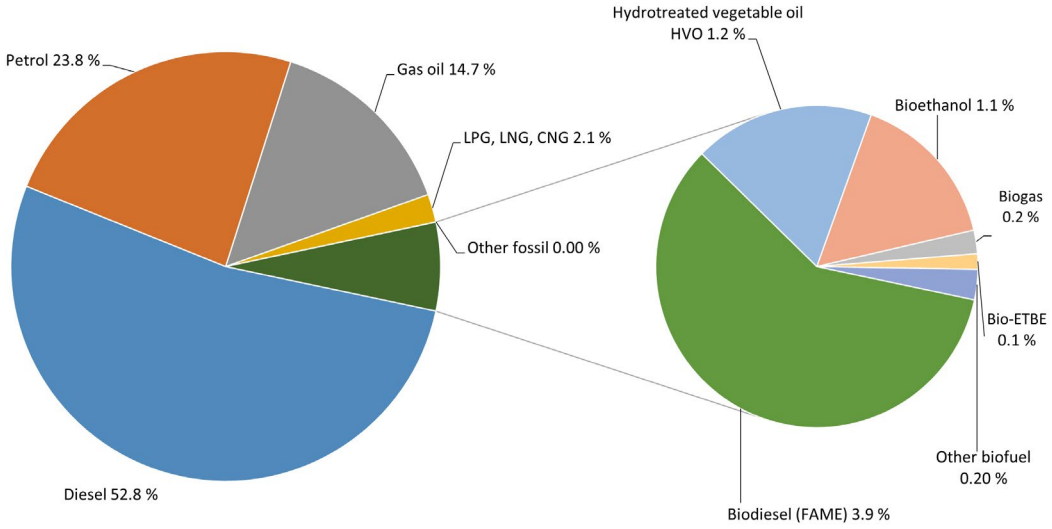
5.2.2 Fuel supply

This section summarises the data submitted by Member States on all fossil fuels, biofuels and fuels of non-biological origin within the scope of the Fuel Quality Directive for road transport and non-road mobile machinery.

Total fuel supply reported by the 27 Member States in 2022 was 11 164 petajoules (PJ), representing a slight decrease of 4% compared with 2021. The fuel supply remained dominated by fossil fuels (93.4%) followed by biofuels (6.6%) and a very minor share (0.04%) of electricity (see Section 5.2.4). No renewable fuels of non-biological origin were reported in 2022.

Fossil fuel supply remained dominated in 2022 by diesel (52.8%; 5 892 PJ), followed by petrol (23.8%; 2 658 PJ) and gas oil[54] (14.7%; 1 637 PJ). Liquefied petroleum gas and natural gas had a combined share of 2.1% (236 PJ) (see Figure 5.2).

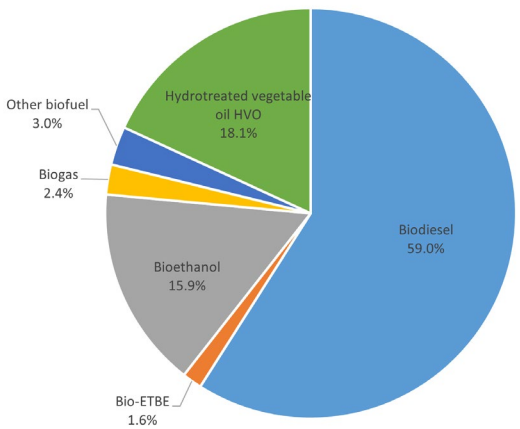
Figure 5.2: Fuel energy supply shares per fuel type in 2022 (Source: EEA)



5.2.3 Biofuel consumption

Total biofuel consumption decreased slightly from 781 PJ to 742 PJ between 2021 and 2022 in the 27 Member States. It remains dominated by biodiesel (fatty acid methyl ester, FAME), which accounts for 59.08% of total biofuel consumption (438 PJ), followed by hydrotreated vegetable oil (HVO) (18.1%; 134 PJ), and bioethanol (15.9%; 118 PJ). Bio-ethyl tert-butyl ether (bio-ETBE) accounted for 1.6% (12 PJ) and biogas for 2.4% (17 PJ) of the total biofuel consumption. The other biofuels collectively accounted for 3.0% (23 PJ) (see Figure 5.3). This means that almost 80% of all biofuels are blended into diesel fuel. Detailed information for all biofuels and pathways can be found in the EEA Technical Report No 2024/04.

Figure 5.3: Biofuel energy supply shares per fuel type in 2022 (Source: EEA)



54 "Gas oil" denotes fuel used for non-road mobile machinery as per definition in Article 2(3) of the Fuel Quality Directive.

5.2.4 Electricity consumption

The reporting of electricity consumption by fuel suppliers is voluntary. 19 Member States (compared to 11 in 2021) reported data on electricity consumed by electric vehicles, including motorcycles (see Table 5.1). The total reported quantity of electricity consumed by electric vehicles increased by approximatelly 10% from 9 859 593 GJ in 2021 to 10 829 451 GJ (excluding power-train efficiency adjustment). The actual electricity consumption of electric vehicles in the different Member States may be greater because reporting of electricity was compulsory under Article 7a and some Member States did not report it, even thogh it would help them achieve the 6% target.

Table 5.1: Electricity consumed by electric vehicles and motorcycles in 2022 as a reported contribution by fuel suppliers to their GHG reduction target (Source: EEA)

Member State	Quantity of energy		GHG intensity	
	excluding powertrain efficiency (GJ)	including powertrain efficiency (GJ)[55]	reported by Member State (g CO_2e/MJ)	reported by Member State (g CO_2e/kWh)
Austria	334 033	133 613	18	64
Belgium	21 443	8 577	74	266
Czechia	20 114	8 046	177	637
Croatia	125	50	0	0
Denmark	31 286	12 514	58	207
Estonia	72 361	28 944	114	412
France	5 083 200	2 033 280	14	52
Germany	4 285	1 714	119	428
Greece	3 373	1 349	117	420
Hungary	39 585	15 834	62	225
Ireland	458 711	183 484	96	346
Italy	480 102	192 041	110	397
Netherlands	3 900 000	1 560 000	94	337
Poland	6 495	2 598	200	721
Portugal	145 139	58 055	56	203
Slovakia	206 048	82 419	46	167
Slovenia	8 221	3 289	84	304
Spain	5 624	2 250	83	299
Sweden	9 306	3 722	7	26
Total	**10 829 451**	**4 331 779**		

5.3 Overview of the EU's 2022 fuel quality data

In accordance withe Article 8 of the Fuel Quality Directive, all 27 Member States, Iceland; Norway and the United Kingdom (in respect of Northern Ireland) submitted reports on national fuel quality data for 2022.

This section provides the data for petrol and diesel sales, and the biocomponents included therein, for road transport reported by the 27 EU Member States. It excludes other fossil fuels, other biofuels and fuels of non-biological origin, and fuels used for non-road mobile machinery. More detailed information on fuel quality can be found in EEA Technical Report No 2024/02 on "Fuel quality monitoring in the EU in 2022"[56].

5.3.1 Petrol and diesel

The share of diesel remained stable between 2017 and 2022, representing 71.5% of total sales in 2022. The total amount of diesel sold in 2022 decreased by 0.9 percentage points when compared with 2021. In parallel, petrol sales in 2022 increased by 1.1 percentage points when compared with 2021 (see Table 5.2).

55 In accordance with Annex I, Part 1 of the Council Directive (EU) 2015/652, the GHG reduction target is calculated on the basis of electricity quantities using the adjustment factor for the EV technology, which corresponds to the inclusion of the powertrain efficiency.
56 https://www.eionet.europa.eu/etcs/etc-cm/products/etc-cm-report-2024-02

Table 5.2: Diesel and petrol fuel sales for the EU-27 (in ml litres and their respective shares) in 2017/2022

	2017	2018	2019	2020	2021	2022
Diesel fuel sales	235 388 (73.3%)	241 653 (73.3%)	246 865 (73.0%)	217 395 (73.2%)	231 224 (72.6%)	233 348 (71.5%)
Petrol fuel sales	85 911 (26.7%)	87 994 (26.7%)	90 917 (27.0%)	79 659 (26.8%)	87 385 (27.4%)	92 921 (28.5%)
Total (diesel and petrol)	**321 299**	**329 629**	**337 782**	**297 054**	**318 609**	**326 269**

Diesel fuel consumption is dominant in all EU Member States, except in the Netherlands and Cyprus where the proportion of petrol use is 51%. Member States with relatively high petrol consumption are Greece and Finland (45% and 37% respectively). By contrast, the corresponding petrol shares in Bulgaria, Lithuania and Latvia, range from 19%, 16% to 14% respectively.

There were no significant changes in the distribution of petrol sales in terms of petrol grade research octane numbers (RON) between 2021 and 2022. Most petrol sales in 2022 involved fuels with a petrol grade of RON 95 while the share of RON ≥ 98 sales slightly decreased. Small changes were made in the reporting template where category 95 < RON < 98 was removed to harmonise reporting and remove some potential inconsistencies (see Table 5.3).

Table 5.3: Share of petrol sales in the EU-27 according to RON numbers

	2017	2018	2019	2020	2021	2022
RON 95	84.3%	80.0%	77.8%	79.3%	80.5%	95.1%
95 < RON < 98	8.5%	14.9%	16.7%	14.3%	13.1%	-
RON ≥ 98	6.9%	4.9%	5.4%	6.4%	6.4%	4.9%
RON = 91	0.2%	0.2%	0.1%	0.01%	0.03%	0.01%

5.3.2: Biocomponents content

In 2022, all petrol and diesel sold in the EU was marketed as containing biocomponents. 61.5% of all petrol sold, .5% contained up to 5% ethanol content by volume (E5), while 37.6% contained up to 10% ethanol content (E10); 0.9% of petrol contained more than 10% ethanol (E+[57]).

All diesel fuel sold in 2022 contained biocomponents. 99.8% of diesel fuel contained up to 7% FAME (B7) and 0.2% contained more than 7% (B+)[58] (see Table 5.4).

Table 5.4: Use of biocomponents in petrol and diesel fuels sold in the EU-27 in 2017-2022

Fuel type		2017	2018	2019	202	2021	2022
Petrol	**E0**	14.5%	4.9%	0.7%	0.0%	0.0%	0.0%
	E5	66.7%	81.5%	73.3%	65.7%	65.4%	61.5%
	E10	18.6%	13.4%	25.7%	33.3%	34.2%	37.6%
	E+	0.1%	0.2%	0.4%	1.0%	0.4%	0.9%
Diesel	**B0**	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	B7	81.8%	99.2%	99.1%	86.2%	99.8%	99.8%
	B+	16.2%	0.8%	0.8%	123.8%	0.2%	0.2%

57 E+ is petrol fuel with > 10% (% v/v) ethanol content.
58 B+ is diesel fuel with > 7 % (% v/v) biodiesel content.

5.3.3: Compliance of sold fuels with quality limits

A high compliance with the fuel quality limits is observed in the EU as a whole. A very large majority of key fuel parameters in the samples taken in 2022 were reported as being within the tolerance limits.

6 Member States (Ireland, Croatia, Cyprus, Lithuania, the Netherlands and Sweden) verified and reported full compliance for both petrol and diesel fuels. 9 Member States verified and reported full compliance for petrol (Ireland, Croatia, Cyprus, Lithuania, Malta, the Netherlands, Romania, Slovenia and Sweden), and 15 for diesel (Czechia, Denmark, Ireland, Greece, Croatia, Cyprus, Lithuania, Luxembourg, Hungary, the Netherlands, Austria, Poland, Portugal, Finland and Sweden).

Member States reported a total of 124 cases of non-compliance for petrol and 125 cases for diesel in 2022. For petrol, the most common parameters falling outside the specifications were exceedances of the summer vapour pressure (in 16 Member States), RON in 4 Member States; and motor octane number (MON), aromatics content and sulphur content (in 3 Member States for all 3 parameters). For diesel, the most common parameters falling outside the specifications were the sulphur content and density of 15 oC (in 6 Member States for both parameters) and the FAME content (in 5 Member States).

All Member States described the actions taken when non-compliant samples were identified. These actions included informing the competent authorities, initiating investigations, imposing penalties and fines, and resampling. In a small number of cases, no action was taken when the non-compliant parameters were found to be very close to the tolerance limits.

There was therefore no need for the Commission to launch any investigation in this area. It can be concluded that the fuel quality monitoring system in place ensures that high-quality fuels are sold in the EU in accordance with the requirements of the Fuel Quality Directive.

6. EU ETS EMISSIONS

Table 6.1: Verified emissions data from the EU Emissions Trading System (EU ETS) – from power and industry installations (broken down by electricity and heat generation and industrial production) and from aircraft operators.

	2019	2020	2021	2022	2023
Verified emissions from power and industry installations	**1 530**	**1 356** (1 253 UK excl.)	**1 337**	**1 313**	**1096**
Change year-on-year	**-9.1%**	**-11.4%**	**-1.4%** (6.6% UK excl.)	**-1.8%**	**-16.5%**
Verified emissions from electricity and heat generation	822	696 (653 UK excl.)	708	725	552
Change year-on-year	-14.7%	-15.3%	1.6% (8.5% UK excl.)	2.4%	-23.9%
Verified emissions from industrial production	708	660 (601 UK excl.).	629	588	544
Change year-on-year	-1.6%	-6.9%	-4.7% (4.7% UK excl.)	-6.4%	-7.5%
Verified emissions from aircraft operators (million tonnes CO_2eq)	**68.2**	**25.2**	**27.9**	**49.5**	**54.1**
Change year-on-year[59]	**+1%**	**-63%**	**+30%**	**+77%**	**+9.5%**

59 Considering the updated scope of aviation in the EU ETS (without incoming flights from the UK).

7. Use of revenues from auctioning of ETS allowances

The table below includes information from Member States' annual reports on the use of the EU Emission Trading System (ETS) auction revenue as required by the Regulation on the Governance of the Energy Union and Climate Action[60]. As of 5 June 2023, Member States must spend all ETS revenue (or an equivalent financial value) on energy- and climate-related purposes listed in Article 10(3) of the ETS Directive[61], except for any revenue spent in aid for indirect carbon costs under Article 10a(6) of the Directive.

In cases where Member States reported spending their auction revenue in aid for indirect carbon costs[62], this value was deducted from the total revenue[63] to obtain the value of the revenue to be spent on the purposes of Article 10(3). For the revenue that Member States collected until 4 June 2023, they were encouraged to use at least 50% of revenues from general allowances and 100% from aviation allowances for the Article 10(3) purposes.

For the data on the Member States' use of their ETS auction revenue in the 2013-2022 period, see the Climate Action Progress Report 2023[64].

Table 7.1: Member States' generated revenue from the auctioning of ETS allowances in 2023 to be spent on climate and energy-related purposes (EUR million) and the share reported as disbursed (%)[65].

Austria		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	435.4	100%
Revenue is not earmarked. Reported equivalent financial value spending on climate and energy purposes is higher than the auction revenue. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the improvement/extension of railway infrastructure, which includes spending on the Brenner base tunnel (EUR 1 183.1 million).		
Belgium		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	541.2	41%
Flanders reported spending EUR 212.3 million of its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Belgium's total revenue for the purpose of calculating the amount Belgium must spend on the purposes of Article 10(3). 59% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as carried over for future spending and reporting. Additionally, EUR 69.9 million of the pre-2023 revenue was reported as disbursed in 2023 and EUR 193.7 million of the pre-2023 revenue was reported as committed in 2023. Since 2023, the direct spending of auction revenue is on hold pending a legal decision on a division between the regions and the federal government. The amount reported as disbursed in 2023 comes temporarily from the regional general budgets and is to be offset when the 2023 revenue becomes available. The purpose reported in 2023 with the biggest allocation from the ETS revenue is supporting the low-carbon transition of businesses, via WalEnergie (EUR 85.0 million).		
Bulgaria		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	1 172.2	100%
Almost all 2023 revenue is disbursed to the Ministry of Energy's Fund for Security of the Electric Power System (FSES) that compensates non-domestic end-users for the rise in electricity prices (EUR 1,167.6 million).		

60 COM(2024)550 final
61 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC (OJ L 275 25.10.2003, p. 32)
62 See Carbon Market Report 2024, Chapter 8.1. At the time the current report is being finalised, the Carbon Market Report 2024 (the report on the functioning of the EU ETS in 2023) is expected to be adopted in early November. Once adopted, the Carbon Market Report 2024 will be available on the website of the Directorate General Climate Action 'What is the EU ETS'.
63 See Table 2 in the Annex to the Carbon Market Report 2024. At the time the current report is being finalised, the Carbon Market Report 2024 (the report on the functioning of the EU ETS in 2023) is expected to be adopted in early November. Once adopted, the Carbon Market Report 2024 will be available on the website of the Directorate General Climate Action 'What is the EU ETS'.
64 EU Climate Action Progress Report 2023, COM(2023) 653 final, 24.10.2023.
65 Data in this table is based on the annual reporting by the Member States with some modifications made to ensure consistency across all Member States and over the reporting period. The harmonisation, methodology and analysis were conducted by SQ Consult in a study for the European Commission.

Croatia		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	158.9	0%
24% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed and 76% was reported as carried over for future spending and reporting. Additionally, EUR 123.7 million of the pre-2023 revenue was reported as disbursed in 2023 and EUR 151.1 million of the pre-2023 revenue was reported as committed in 2023. According to national law, 100% of the auction revenues is spent on climate and energy purposes via the Environmental Protection and Energy Efficiency Fund (EPEEF). No revenue generated in 2023 was disbursed in 2023. All the revenue disbursed in 2023 came from earlier years. The purpose reported in 2023 with the biggest allocation from the ETS revenues is subsidies for social support and just transition via the EPEEF (EUR 89.9 million).		

Cyprus		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	113.6	91%
9% of the 2023 revenue to be spent was reported as carried over for future spending and reporting. Equivalent financial value is spent on the purposes of Art. 10(3) via the general budget. The purpose reported in 2023 with the biggest allocation from the ETS revenue is Public Passenger Transport by the Ministry of Transport (EUR 79.2 million).		

Czechia		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	777.2	26%
5% of the 2023 revenue to be spent was reported as committed, 59% was reported as carried over for future spending and reporting and the remaining 10% was reported as committed without indication of the purpose. Additionally, EUR 78.0 million of the pre-2023 revenue was reported as disbursed in 2023. Czechia mentioned an ongoing legislative process to enshrine additional spending for the purpose of Art. 10(3) in national law. The purpose reported in 2023 with the biggest allocation from the ETS revenues is the Support of renewable energy sources by the Ministry of Industry and Trade (EUR 167.6 million).		

Denmark		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	416.1	100%
Revenue is not earmarked. Projects for Art. 10(3) purposes with the equivalent financial value have been reported. The purpose reported in 2023 with the biggest allocation from the ETS revenue is grants for upgrading and purification of biogas, implemented by the Danish Energy Agency under the Ministry of Climate, Energy and Utilities (EUR 287.6 million).		

Estonia		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	360.0	2%
50% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed and the remaining 48% of the 2023 revenue has not been described in the report. Additionally, EUR 152.7 million of the pre-2023 revenue was reported as disbursed in 2023. Up to 2023, 50% of the auctioning revenues were earmarked and directed through the four-year State Budget Strategy and spent on Art. 10(3) purposes, which may take multiple years. Any unspent revenue is carried over to later years and always used for climate and energy projects. The remaining 50% went to the general budget. From 2024 onwards, 100% of revenue will be earmarked for Art 10(3) purposes. The purpose reported in 2023 with the biggest allocation from the ETS revenues is grants to increase energy efficiency in public sector buildings, implemented by the State Shared Service Centre (EUR 125.6 million).		

Finland		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	466.0	100%
Finland reported spending EUR 115.6 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Finland's total revenues for the purpose of calculating the amount Finland must spend on the purposes of Article 10(3). Revenue is not earmarked. Equivalent spending of slightly more than the revenue to be spent on the purposes of Art. 10(3) was reported for 2023. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the development of public transport and purchase of public transportation services (EUR 193.3 million).		
France		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	2 100.2	100%
The auction revenue co-funds energy efficiency improvements of low-income housing, up to a ceiling of EUR 700 million per year. The remainder is not earmarked but goes to the general budget, from which the equivalent financial value is reported. The purpose reported in 2023 with the biggest allocation from the ETS revenue is improving railway networks for enhanced performance and expanded national and European rail connectivity (EUR 1 400.2 million).		
Germany		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	7 022.2	100%
Germany reported spending EUR 623.3 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Germany's total revenue for the purpose of calculating the amount Germany must spend on the purposes of Article 10(3). Germany's EUR 7.6 billion auction revenue co-funded EUR 18.5 billion in spending on Article 10(3) purposes and indirect carbon costs (Germany's total indirect carbon costs amounted to EUR 1.6 billion, with 37% of this figure attributed to the auction revenue in this table). The purpose reported in 2023 with the biggest allocation from the ETS revenue is promoting energy efficiency and renewable energy measures in the building sector, implemented by the Bundesministerium für Wirtschaft und Klimaschutz (EUR 11 049.5 million).		
Greece		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	1 201.7	100%
Greece reported spending EUR 264.8 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Greece's total revenue for the purpose of calculating the amount Greece must spend on the purposes of Article 10(3). Almost all revenue to be spent on the purposes of Article 10(3) goes to the Energy Transition Fund for social support and just transition, coordinated by the Greek Renewable Energy Sources Operator and Guarantees of Origin "DAPEEP" (EUR 1 131.7 million)		
Hungary		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	438.9	30%
9% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed and the remaining 61% of the 2023 revenue has not been described in the report. Additionally, EUR 176.2 million of the pre-2023 revenue was reported as disbursed in 2023 and EUR 28.7 million of the pre-2023 revenue was reported as committed in 2023. Revenue is earmarked for Art. 10(3) purposes, any revenue not spent is carried over to future years. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the implementation of a residential PV and storage support programme via NFFKÜ International Development and Resource Coordination Agency (EUR 104.6 million).		

Ireland		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	158.3	100%
Revenue is not earmarked for specific purposes. The amounts reported are equivalent to 100% of this revenue and are allocated to emission reduction activities in line with the purposes of Art 10(3). The purpose reported in 2023 with the biggest allocation from the ETS revenue is public transport investment by the Department of Transport (EUR 117.3 million).		
Italy		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	3 547.4	0%
All 2023 revenue was reported as carried over for future spending and reporting. Additionally, EUR 23.2 million of the pre-2023 revenue was reported as disbursed in 2023 and EUR 23.8 million of the pre-2023 revenues was reported as committed in 2023. Following the Italian financial rules, committing or disbursing of the 2023 auction revenue will start in 2024. All reported spending corresponds to the revenue generated in 2022 or before. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the financing of sustainable mobility interventions in public transport and mobility (EUR 20.0 million).		
Latvia		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	90.8	30%
32% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed and 38% was reported as carried over for future spending and reporting. All auction revenue goes to the 'EAAI', a national green investment scheme, aimed at tackling global climate change. The purpose reported in 2023 with the biggest allocation from the ETS revenue is reducing greenhouse gas emissions in national protected architectural monuments through an open tender, implemented by the Ministry of Climate and Energy and Environmental Investment Fund (EUR 19.5 million).		
Lithuania		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	113.7	61%
36% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed and 36% was reported as carried over for future spending and reporting. The auction revenue funds the four-year (2022-2025) Climate Change Programme. Funds are committed when funding applications are accepted, payments are made after the projects are implemented. The purpose reported in 2023 with the biggest allocation from the ETS revenue is investment support for biomethane production and/or biodegradation to promote green energy development (EUR 31.0 million).		
Luxembourg		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	9.3	100%
Auction revenue, together with the climate contribution on road fuels and a share (40%) of the annual motor vehicle tax, finance the Climate and Energy Fund. An equivalent amount of Article 10(3) actions supported from this fund was reported. The purpose reported in 2023 with the biggest allocation from the ETS revenue is Climate and Energy Fund activities (EUR 9.3 million).		

Malta		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	1 281.4	100%
Revenue is not earmarked. An equivalent spending of 26% more than the revenue to be spent on the purposes of Art. 10(3) was reported for 2023. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the ARMS Feed-in-tariff project in Malta (EUR 13.1 million).		
Netherlands		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	1 281.4	100%
Revenue is not earmarked. Equivalent spending has been reported as part of the spending under several large climate policies. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the Investment Subsidy for Sustainable Energy (ISDE) programme (EUR 510.7 million).		
Poland		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	4 988.1	92%
Poland reported spending EUR 384.4 million from its 2023 auction revenues to compensate for indirect carbon costs. This amount was deducted from Poland's total revenues for the purpose of calculating the amount Poland must spend on the purposes of Article 10(3). Of the 2023 revenue to be spent on the purposes of Article 10(3), the remaining 8% has not been explained in the report. Revenue is not earmarked. The equivalent financial value of actions for the purposes in Art. 10(3) has been reported. The purpose reported in 2023 with the biggest allocation from ETS revenues is compensation for certain recipients of gas fuels, implemented by Zarządca Rozliczeń (EUR 1 424.8 million).		
Portugal		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	720.0	96%
Portugal reported spending EUR 25.0 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Portugal's total revenue for the purpose of calculating the amount Portugal must spend on the purposes of Article 10(3). 4% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as carried over for future spending and reporting. All auction revenue is channelled to the Environment Fund (alongside other revenue), which finances environmental projects that may or may not be directly related to climate objectives. The amounts reported as spent represent climate change and energy projects financed from the Environmental Fund. The purpose reported in 2023 with the biggest allocation from the ETS revenue is to support renewables in the National Energetic System (SEN) (EUR 436.0 million).		
Romania		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	475.9	100%
Romania reported spending EUR 104.4 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Romania's total revenues for the purpose of calculating the amount Romania must spend on the purposes of Article 10(3). Distribution of auction revenue to different purposes is governed by law GEO 115/2011. The purpose reported in 2023 with the biggest allocation from the ETS revenue is the installation of photovoltaic panel systems for electricity production and surplus delivery to the national grid, implemented by Administrația Fondului pentru Mediu "AFM" (EUR 201.1 million).		

Slovakia		Total percentage disbursed up to the year indicated
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	298.0	31%
Slovakia reported spending EUR 80.3 million from its 2023 auction revenues to compensate for indirect carbon costs. This amount was deducted from Slovakia's total revenue for the purpose of calculating the amount Slovakia must spend on the purposes of Article 10(3). 27% of the 2023 revenues to be spent on the purposes of Article 10(3) was reported as committed and 42% was reported as carried over for future spending and reporting. All auction revenue is earmarked and goes to the Environmental Fund, which is spent on purposes in Article 10(3). The purpose reported in 2023 with the biggest allocation from the ETS revenue is a programme for water pipes and sewers, including water retention measures (EUR 59.2 million).		
Slovenia		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	161.1	79%
Slovenia reported spending EUR 26.0 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Slovenia's total revenue for the purpose of calculating the amount Slovenia must spend on the purposes of Article 10(3). 21% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as committed. All auction revenue is used for purposes in Article 10(3), coordinated through the Climate Change Fund. The purpose reported in 2023 with the biggest allocation from the ETS revenue is investments in thermal insulation of buildings and efficient heating (EUR 38.0 million).		
Spain		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	3 355.5	33%
Spain reported spending EUR 228.8 million from its 2023 auction revenue to compensate for indirect carbon costs. This amount was deducted from Spain's total revenue for the purpose of calculating the amount Spain must spend on the purposes of Article 10(3). 67% of the 2023 revenue to be spent on the purposes of Article 10(3) was reported as carried over for future spending and reporting. Estimated revenue is earmarked for energy and climate purposes ahead of each year, so the actual revenue may differ from the allocated estimate. All estimated revenue that is not used in aid for indirect carbon cost (excluded in the values above) is used for climate and energy purposes. The purpose reported in 2023 with the biggest allocation from the ETS revenue is financing the costs of the electric system related to promoting renewable energies (EUR 1 100.0 million).		
Sweden		**Total percentage disbursed up to the year indicated**
Year of generation of revenue	Revenue to be spent on the purposes of Art. 10(3) (EUR million)	2023
2023	323.2	0%
100% of the 2023 revenue to be spent was reported as committed. Revenue is not earmarked. Example projects have been reported for at least the minimum required spending on energy and climate purposes. The purpose reported in 2023 with the biggest allocation from the ETS revenue is to Climate Leap. This funds local and regional investments in greenhouse gas emission reduction based on the expected emission reductions relative to the investment cost, and is implemented by the Swedish Environmental Protection Agency "Naturvårdsverket" (EUR 209.9 million).		

8. Emissions covered by the effort sharing legislation

By 30 June 2024, Member States had to report their final updated integrated National Energy and Climate Plans (NECPs) to the Commission[66]. The updated NECPs should contain the policies and measures that a Member State envisages to meet their climate and energy targets. The updated NECPs are currently being assessed by the Commission. The Commission includes in the analysis for 2030 the information from Member States' final updated NECPs, or draft updated NECPs in the absence of more recent information. A more complete overview will be available when the Commissions received final updated NECPs from all Member States.

Table 8.1: Member States targets, historical and projected emissions under the effort-sharing legislation and distance to targets in percentage change from 2005 base year emissions[67]

Member State	2021	2022	2023	2030 (projection WEM)	2030 (projections WAM)
Austria					
Target	-14%	-17%	-21%	-48%	-48%
Emissions	-15%	-19%	-23%	-30%	-42%
Distance to target (percentage point)	0	2	3	-18	-6
Belgium					
Target	-13%	-15%	-19%	-47%	-47%
Emissions	-16%	-22%	-22%	-22%	-43%
Distance to target (percentage point)	3	6	2	-25	-4
Bulgaria					
Target	21%	13%	10%	-10%	-10%
Emissions	13%	10%	5%	4%	2%
Distance to target (percentage point)	9	3	5	-14	-12
Croatia					
Target	-2%	-8%	-9%	-17%	-17%
Emissions	3%	10%	-10%	4%	-17%
Distance to target (percentage point)	-6	3	0	-14	0
Cyprus					
Target	-5%	-7%	-10%	-32%	-32%
Emissions	3%	10%	5%	4%	-23%
Distance to target (percentage point)	-8	3	-15	-14	-9
Czechia					
Target	2%	-6%	-9%	-26%	-26%
Emissions	-5%	10%	-6%	4%	-33%
Distance to target (percentage point)	7	3	-3	-14	7
Denmark					
Target	-20%	-22%	-26%	-50%	-50%
Emissions	-21%	10%	-25%	4%	-44%
Distance to target (percentage point)	1	3	-1	-14	-6
Estonia					
Target	0%	-3%	-6%	-24%	-24%
Emissions	-8%	-19%	-3%	-29%	-14%
Distance to target (percentage point)	8	2	-3	-8	-10

66 By 1 October 2024, 11 Member States have submitted their final updated NECPs.
67 2021 and 2022 emissions are based on 2024 final GHG inventory reports, 2023 emissions are based on 2024 approximated inventory reports. Positive values indicate projected overachievement while negative values indicate projected underachievement. WEM = with existing measures, WAM = with additional measures. The 2005 emissions used for the calculation are set out in Annex I of Commission Implementing Decision (EU) 2020/2126.
Any apparent miscalculations for percentage point distance to targets is due to rounding of the percentage targets and emissions.

Finland					
Target	-16%	-19%	-23%	-50%	-50%
Emissions	-21%	-23%	-27%	-45%	-46%
Distance to target (percentage point)	5	4	4	-5	-4
France					
Target	-16%	-19%	-22%	-47%	-47%
Emissions	-20%	-24%	-26%	-24%	-46%
Distance to target (percentage point)	4	5	4	-23	-1
Germany					
Target	-12%	-15%	-19%	-50%	-50%
Emissions	-17%	-24%	-21%	-44%	-41%
Distance to target (percentage point)	5	5	2	-23	-9
Greece					
Target	-16%	-19%	-22%	-47%	-47%
Emissions	-20%	-24%	-26%	-24%	-46%
Distance to target (percentage point)	4	5	4	-23	-1
Hungary					
Target	4%	-9%	-11%	-19%	-19%
Emissions	-4%	-8%	-15%	-15%	-25%
Distance to target (percentage point)	8	-1	4	-3	6
Ireland					
Target	-9%	-11%	-15%	-42%	-42%
Emissions	-3%	-4%	-10%	-9%	-25%
Distance to target (percentage point)	-6	-7	-5	-33	-17
Italy					
Target	-20%	-22%	-24%	-43%	-43%
Emissions	-18%	-21%	-22%	-29%	-41%
Distance to target (percentage point)	-2	-1	-2	-14	-3
Latvia					
Target	24%	3%	0%	-17%	-17%
Emissions	1%	-21%	-4%	-29%	-21%
Distance to target (percentage point)	23	-1	5	-14	4
Lituania					
Target	23%	5%	2%	-21%	-21%
Emissions	9%	-21%	4%	-29%	-21%
Distance to target (percentage point)	14	-1	-2	-14	0
Luxembourg					
Target	-17%	-19%	-23%	-50%	-50%
Emissions	-20%	-21%	-32%	-29%	-56%
Distance to target (percentage point)	3	-1	8	-14	6
Malta					
Target	102%	21%	16%	-19%	-19%
Emissions	30%	-30%	31%	-33%	46%
Distance to target (percentage point)	72	11	-14	-17	-65
Netherlands					
Target	-23%	-25%	-27%	-48%	-48%
Emissions	-27%	-2%	-34%	-12%	-39%
Distance to target (percentage point)	4	5	7	-5	-9

Poland					
Target	12%	6%	3%	-18%	-18%
Emissions	8%	2%	4%	-14%	-7%
Distance to target (percentage point)	4	4	-1	-4	-11
Portugal					
Target	-13%	-16%	-18%	-29%	-29%
Emissions	-18%	2%	-19%	-14%	-42%
Distance to target (percentage point)	5	4	1	-4	13
Romania					
Target	12%	-2%	-3%	-13%	-13%
Emissions	6%	4%	4%	-9%	-15%
Distance to target (percentage point)	6	-6	-7	-4	3
Slovakia					
Target	1%	-9%	-10%	-23%	-23%
Emissions	-12%	-15%	-14%	-1%	-12%
Distance to target (percentage point)	13	7	4	-21	-11
Slovenia					
Target	-4%	-6%	-9%	-26%	-26%
Emissions	-12%	-15%	-15%	-1%	-29%
Distance to target (percentage point)	9	7	6	-21	3
Spain					
Target	-17%	-18%	-20%	-37%	-37%
Emissions	-20%	-15%	-21%	-1%	-45%
Distance to target (percentage point)	3	7	1	-21	7
Sweden					
Target	-28%	-29%	-32%	-50%	-50%
Emissions	-33%	-15%	-38%	-1%	-44%
Distance to target (percentage point)	5	7	6	-21	-6
EU 27					
Target	-12%	-15%	-18%	-40%	-40%
Emissions	-15%	-18%	-19%	-28%	-37%
Distance to target (percentage point)	3	3	1	-11	-3
Iceland					
Target	-7%	-10%	-12%	-29%	-29%
Emissions	-11%	-11%	-14%	-24%	-26%
Distance to target (percentage point)	4	1	1	-4	-3
Norway					
Target	-13%	-16%	-19%	-40%	-40%
Emissions	-12%	-13%	-16%	-32%	-32%
Distance to target (percentage point)	-1	-3	-3	-8	-8

Table 8.2: Annual emissions allocations, historical and projected emissions, and distance to targets under the Effort Sharing Regulation (Mt. CO_2-eq.) covering the period 2021 - 2030. Positive values indicate overachievement, negative values indicate underachievement[68,69].

Member State	ETS and LULUCF flexibility	2005 base year emissions	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Austria												
Estimated AEAs			48.8	47.4	45.2	43.0	40.7	40.2	37.6	34.9	32.3	29.6
Emissions		57.0	48.6	46.2	43.7	43.9	42.4	40.9	39.3	37.3	35.3	33.2
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.											
Distance to target			0.1	1.2	1.5	-0.9	-1.6	-0.7	-1.8	-2.3	-3.0	-3.6
Cumulative balance of AEAs			0.1	1.4	2.8	1.9	0.3	-0.4	-2.2	-4.5	-7.5	-11.1
ETS flexibility	11.4		Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	2.5		The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Belgium												
Estimated AEAs			71.1	69.1	65.9	62.7	59.4	57.5	53.9	50.4	46.8	43.3
Emissions		81.6	68.8	63.8	63.9	64.4	62.7	59.6	56.4	53.2	50.0	46.8
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.											
Distance to target			2.4	5.3	2.0	-1.8	-3.3	-2.1	-2.4	-2.8	-3.2	-3.6
Cumulative balance of AEAs			2.4	7.7	9.7	7.9	4.6	2.5	0.1	-2.7	-5.9	-9.5
ETS flexibility	15.4		Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	3.8		The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Bulgaria												
Estimated AEAs			27.1	25.2	24.5	23.9	23.3	22.8	22.1	21.5	20.8	20.1
Emissions		22.3	25.1	24.5	23.4	23.6	23.6	23.4	23.3	23.1	23.0	22.8
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.											
Distance to target			2.0	0.6	1.1	0.3	-0.3	-0.6	-1.1	-1.6	-2.2	-2.7
Cumulative balance of AEAs			2.0	2.6	3.7	4.0	3.7	3.1	2.0	0.4	-1.8	-4.5
ETS flexibility	0.0		Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	4.1		The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Croatia												
Estimated AEAs			17.7	16.5	16.4	16.2	16.0	17.0	16.5	16.0	15.5	15.0
Emissions		18.1	18.7	19.2	16.3	16.1	15.9	15.8	15.6	15.4	15.2	15.0

68 AEAs for the years 2021-2025 are established in Implementing Decision (EU) 2020/2126. AEAs for the years 2026 -2030 are estimated based on the trajectory defined in Article 4 ESR and adjusted as provided for under Article 10(1)c ESR. To estimate the trajectory for 2026-2030, the estimated ESR emissions for the years 2021 to 2023 are used, after a reduction by the Article 10(1)c ESR adjustment included in the AEAs for 2021-2023. The trajectory values are adjusted based on Article 10(1)c on the basis of the assumption that the methodology applied to the AEAs for 2021 to 2025 is continued unchanged for the years 2026-2030, and no further adjustments for changes to EU ETS are required. The final AEAs for these years will be established after the comprehensive review in 2025 pursuant to Article 38(1a) of Regulation (EU) 2018/1999. The values of 'cumulative surplus of AEAs' are the cumulative annual distances to target and do not take into account cancellations and transfers. 2021 and 2022 emissions are based on 2024 final GHG inventory reports, 2023 emissions are based on 2024 approximated inventory reports. 2024 - 2030 emissions are based on the most recent WAM emissions projections reports, or in the absence of WAM projections the WEM projections. First compliance check will take place in 2027.

69 Poland's estimated ESR emissions are based on their WEM projections from its draft updated NECP which is more ambitious than its WAM projections from their NECPR reporting in 2023. See also SWD(2024) 126 final.

LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		-1.0	-2.7	0.1	0.1	0.0	1.2	0.9	0.6	0.3	0.1
Cumulative balance of AEAs		-1.0	-3.7	-3.6	-3.5	-3.5	-2.2	-1.3	-0.7	-0.4	-0.3
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	0.9	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Cyprus											
Estimated AEAs		4.1	4.0	3.8	3.7	3.6	3.9	3.6	3.4	3.1	2.9
Emissions	4.3	4.4	4.4	4.5	4.3	4.3	4.3	4.2	4.1	4.0	3.3
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		-0.3	-0.5	-0.6	-0.6	-0.7	-0.4	-0.6	-0.7	-0.9	-0.4
Cumulative balance of AEAs		-0.3	-0.8	-1.4	-2.0	-2.8	-3.2	-3.8	-4.5	-5.4	-5.8
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	0.6	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Czechia											
Estimated AEAs		66.0	60.9	59.3	57.7	56.1	58.4	55.8	53.3	50.7	48.1
Emissions	65.0	61.5	60.6	70.6	56.7	56.6	55.7	54.7	53.8	52.8	43.4
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		4.4	0.3	-11.3	1.0	-0.5	2.8	1.1	-0.5	-2.2	4.7
Cumulative balance of AEAs		4.4	4.7	-6.6	-5.5	-6.1	-3.3	-2.2	-2.7	-4.9	-0.2
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	2.6	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Denmark											
Estimated AEAs		32.1	31.3	29.9	28.5	27.1	27.1	25.4	23.6	21.9	20.2
Emissions	40.4	31.9	30.7	30.3	28.3	27.2	26.1	25.0	24.1	23.3	22.4
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		0.3	0.6	-0.4	0.2	0.0	0.9	0.4	-0.5	-1.4	-2.3
Cumulative balance of AEAs		0.3	0.8	0.4	0.6	0.6	1.5	1.9	1.4	0.0	-2.2
ETS flexibility	8.1	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	14.6	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Estonia											
Estimated AEAs		6.2	6.0	5.8	5.7	5.5	5.4	5.2	5.0	4.9	4.7
Emissions	6.2	5.7	5.5	6.0	5.7	5.6	5.6	5.5	5.5	5.4	5.3
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										

Distance to target		0.5	0.5	-0.2	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.6
Cumulative balance of AEAs		0.5	1.0	0.8	0.8	0.7	0.5	0.2	-0.2	-0.8	-1.4
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	0.9	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Finland											
Estimated AEAs		28.8	28.0	26.6	25.3	23.9	23.0	21.6	20.1	18.7	17.2
Emissions	34.4	27.2	26.5	25.1	23.1	22.2	21.6	20.8	20.0	19.3	18.5
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		1.6	1.4	1.5	2.2	1.7	1.4	0.8	0.1	-0.6	-1.2
Cumulative balance of AEAs		1.6	3.1	4.6	6.8	8.5	9.9	10.7	10.8	10.2	8.9
ETS flexibility	6.9	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	4.5	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
France											
Estimated AEAs		335.7	326.5	312.0	297.5	283.0	273.0	257.4	241.8	226.2	210.6
Emissions	401.1	320.2	306.2	297.7	299.6	297.1	291.0	285.0	278.9	272.8	215.0
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		15.5	20.4	14.3	-2.1	-14.1	-18.1	-27.6	-37.1	-46.6	-4.4
Cumulative balance of AEAs		15.5	35.8	50.2	48.1	34.0	15.9	-11.7	-48.8	-95.3	-99.7
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	58.2	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Germany											
Estimated AEAs		427.3	413.2	391.9	370.5	349.2	339.5	315.2	290.9	266.7	242.4
Emissions	484.7	403.8	395.0	383.5	369.6	360.1	350.7	338.2	323.9	306.8	287.5
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		23.5	18.3	8.3	0.9	-10.9	-11.3	-23.0	-33.0	-40.1	-45.1
Cumulative balance of AEAs		23.5	41.8	50.1	51.0	40.1	28.8	5.8	-27.1	-67.3	-112.3
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	22.3	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Greece											
Estimated AEAs		46.2	47.0	47.2	47.4	47.6	46.1	46.7	47.4	48.0	48.7
Emissions	63.0	44.4	46.3	43.3	43.1	43.0	42.5	42.0	41.6	41.1	34.0
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		1.8	0.7	3.9	4.3	4.6	3.6	4.7	5.8	6.9	14.7
Cumulative balance of AEAs		1.8	2.5	6.4	10.8	15.4	19.0	23.7	29.6	36.5	51.2

ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	6.7	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Hungary											
Estimated AEAs		49.9	43.3	42.8	42.2	41.7	41.9	41.2	40.4	39.6	38.9
Emissions	47.8	46.1	44.0	40.8	43.5	43.4	43.1	42.8	42.5	42.2	36.4
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		3.8	-0.6	2.0	-1.2	-1.8	-1.2	-1.7	-2.1	-2.6	2.5
Cumulative balance of AEAs		3.8	3.2	5.2	3.9	2.1	0.9	-0.7	-2.8	-5.4	-2.9
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	2.1	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Ireland											
Estimated AEAs		43.5	42.4	40.5	38.7	36.8	38.8	36.0	33.2	30.4	27.7
Emissions	47.7	46.4	45.9	42.8	44.3	43.3	42.0	40.6	39.1	37.5	35.6
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		-2.9	-3.5	-2.3	-5.6	-6.4	-3.2	-4.6	-5.8	-7.0	-7.9
Cumulative balance of AEAs		-2.9	-6.5	-8.8	-14.3	-20.8	-24.0	-28.6	-34.4	-41.4	-49.3
ETS flexibility	19.1	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	26.8	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Italy											
Estimated AEAs		273.5	268.8	259.4	250.1	240.7	244.3	231.7	219.1	206.5	193.9
Emissions	343.1	279.9	271.5	266.6	262.6	252.1	246.6	234.9	223.9	213.8	203.7
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		-6.4	-2.7	-7.2	-12.6	-11.4	-2.3	-3.2	-4.9	-7.3	-9.8
Cumulative balance of AEAs		-6.4	-9.2	-16.4	-29.0	-40.3	-42.6	-45.8	-50.7	-58.0	-67.7
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	11.5	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Latvia											
Estimated AEAs		10.6	8.9	8.6	8.4	8.2	8.0	7.8	7.6	7.3	7.1
Emissions	8.6	8.7	8.4	8.3	8.2	8.1	8.0	7.9	7.7	7.6	7.3
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		2.0	0.4	0.4	0.2	0.1	0.0	-0.1	-0.2	-0.3	-0.2
Cumulative balance of AEAs		2.0	2.4	2.8	3.0	3.1	3.1	3.0	2.8	2.5	2.3
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									

Maximum LULUCF flexibility	3.1	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Lithuania											
Estimated AEAs		16.1	13.7	13.3	12.9	12.4	12.6	12.0	11.5	10.9	10.3
Emissions	13.1	14.2	13.9	13.6	13.6	13.1	12.6	12.0	11.5	10.9	10.3
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		1.9	-0.2	-0.3	-0.8	-0.7	0.0	0.0	0.0	0.0	0.0
Cumulative balance of AEAs		1.9	1.7	1.5	0.7	0.0	0.0	0.0	0.1	0.0	0.1
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	6.5	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Luxembourg											
Estimated AEAs		8.4	8.1	7.8	7.4	7.0	6.5	6.2	5.8	5.4	5.1
Emissions	10.1	8.1	7.1	6.9	6.7	6.4	6.0	5.6	5.3	4.9	4.5
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		0.3	1.1	0.9	0.6	0.6	0.5	0.5	0.5	0.5	0.6
Cumulative balance of AEAs		0.3	1.4	2.3	2.9	3.5	4.0	4.5	5.0	5.6	6.2
ETS flexibility	4.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	0.3	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Malta											
Estimated AEAs		2.1	1.2	1.2	1.1	1.1	1.2	1.1	1.0	0.9	0.8
Emissions	1.0	1.3	1.5	1.3	1.5	1.5	1.5	1.5	1.5	1.5	1.5
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		0.7	-0.2	-0.1	-0.3	-0.4	-0.3	-0.4	-0.5	-0.6	-0.7
Cumulative balance of AEAs		0.7	0.5	0.4	0.0	-0.3	-0.6	-1.0	-1.5	-2.0	-2.7
ETS flexibility	0.5	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	0.0	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Netherlands											
Estimated AEAs		98.5	96.7	92.9	89.2	85.4	79.7	76.5	73.2	69.9	66.6
Emissions	128.1	92.9	84.8	83.6	88.3	87.6	85.8	84.0	82.2	80.4	78.6
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		5.6	11.8	9.3	0.8	-2.2	-6.0	-7.5	-9.0	-10.5	-12.0
Cumulative balance of AEAs		5.6	17.4	26.7	27.5	25.4	19.4	11.8	2.8	-7.6	-19.6
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									

Maximum LULUCF flexibility	13.4	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Poland											
Estimated AEAs		215.0	204.4	198.6	192.9	187.1	185.9	179.0	172.1	165.3	158.4
Emissions	192.5	207.3	196.2	200.4	191.9	188.2	186.3	184.4	182.5	180.6	165.3
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		7.7	8.1	-1.8	1.0	-1.0	-0.4	-5.4	-10.3	-15.3	-6.9
Cumulative balance of AEAs		7.7	15.9	14.1	15.0	14.0	13.6	8.2	-2.1	-17.4	-24.3
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	21.7	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Portugal											
Estimated AEAs		42.5	40.8	40.1	39.3	38.5	38.0	37.1	36.3	35.5	34.7
Emissions	48.6	39.9	39.8	39.6	36.9	36.6	34.9	33.3	31.6	29.9	28.2
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		2.6	1.0	0.4	2.4	1.9	3.0	3.9	4.8	5.6	6.5
Cumulative balance of AEAs		2.6	3.6	4.1	6.5	8.4	11.4	15.3	20.1	25.7	32.3
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	5.2	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Romania											
Estimated AEAs		87.9	76.9	75.8	74.8	73.7	76.9	74.8	72.6	70.5	68.3
Emissions	78.2	82.8	81.4	81.2	80.4	80.7	80.9	81.1	81.3	81.5	81.7
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		5.0	-4.4	-5.4	-5.7	-7.0	-3.9	-6.3	-8.7	-11.0	-13.4
Cumulative balance of AEAs		5.0	0.6	-4.7	-10.4	-17.4	-21.3	-27.6	-36.3	-47.3	-60.7
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	13.2	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Slovakia											
Estimated AEAs		23.4	21.2	20.7	20.3	19.9	19.2	18.9	18.5	18.2	17.9
Emissions	23.1	20.3	19.6	19.8	20.7	20.2	20.4	20.5	20.6	20.4	20.5
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		3.1	1.5	0.9	-0.4	-0.3	-1.2	-1.6	-2.0	-2.2	-2.6
Cumulative balance of AEAs		3.1	4.6	5.5	5.2	4.9	3.7	2.1	0.1	-2.2	-4.7
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									

Maximum LULUCF flexibility	1.2	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Slovenia											
Estimated AEAs		11.4	11.1	10.8	10.5	10.2	9.8	9.5	9.3	9.0	8.7
Emissions	11.8	10.4	10.8	10.1	10.2	10.1	9.9	9.6	9.4	9.1	8.4
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		1.0	0.4	0.8	0.3	0.1	-0.1	-0.1	-0.1	-0.1	0.3
Cumulative balance of AEAs		1.0	1.4	2.1	2.4	2.5	2.4	2.3	2.2	2.1	2.4
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	1.3	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Spain											
Estimated AEAs		201.0	198.7	192.8	186.9	181.0	178.4	171.7	165.0	158.2	151.5
Emissions	242.0	194.7	194.8	191.5	175.9	171.0	163.6	156.2	148.7	141.2	133.8
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		6.3	3.8	1.3	11.0	10.0	14.8	15.5	16.2	17.0	17.7
Cumulative balance of AEAs		6.3	10.2	11.4	22.4	32.4	47.2	62.8	79.0	96.0	113.7
ETS flexibility	0.0	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	29.1	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									
Sweden											
Estimated AEAs		31.3	30.7	29.6	28.5	27.3	25.5	24.6	23.6	22.6	21.6
Emissions	43.2	29.1	27.3	26.9	28.2	28.7	27.8	26.9	26.0	25.1	24.2
LULUCF debit (2021-2025)	Pursuant to Art 9(2) ESR, AEAs are reduced by the debit generated under the LULUCF Regulation in the period 2021-2025. See chapter 4 of the main report.										
Distance to target		2.3	3.4	2.7	0.2	-1.4	-2.2	-2.3	-2.4	-2.5	-2.6
Cumulative balance of AEAs		2.3	5.7	8.4	8.6	7.3	5.0	2.7	0.3	-2.2	-4.7
ETS flexibility	5.2	Amount of ETS flexibility as per Commission Implementing Decision 2020/2126 and available over the 10-year period 2021-2030.									
Maximum LULUCF flexibility	4.9	The availability of LULUCF flexibility depends on the amount of LULUCF credits generated under the LULUCF Regulation. The use of the available LULUCF flexibility is limited to 50% of the maximum amount of LULUCF flexibility in the period 2021-2025 and 50% of the maximum amount of LULUCF flexibility in the period 2026-2030.									

BOX ON WASTE EMISSIONS

Key messages

- While the waste sector accounts for 3% of total EU greenhouse gas (GHG) emissions, the better use of waste as a resource can help reduce emissions in other sectors.
- Member States should quantify and better integrate achieved and expected emission reductions of waste and circular economy policies.
- The consumption-based (non-territorial) impacts – in additional to territorial impacts – are sometimes key to understanding the potential of circular economy policies.

1. Scope of waste sector

Achieving the EU's 2050 net-zero climate target demands actions across all economic sectors. These include actions related to materials and how we produce, use, re-circulate and dispose of them. We can track emissions of these actions under the Waste management sector in the officially reported GHG inventories[70]. The sector includes:

- solid waste disposal;
- biological treatment of solid waste;
- incineration and open burning of waste;
- wastewater treatment and discharge (further excluded from this box to keep focus on solid waste).

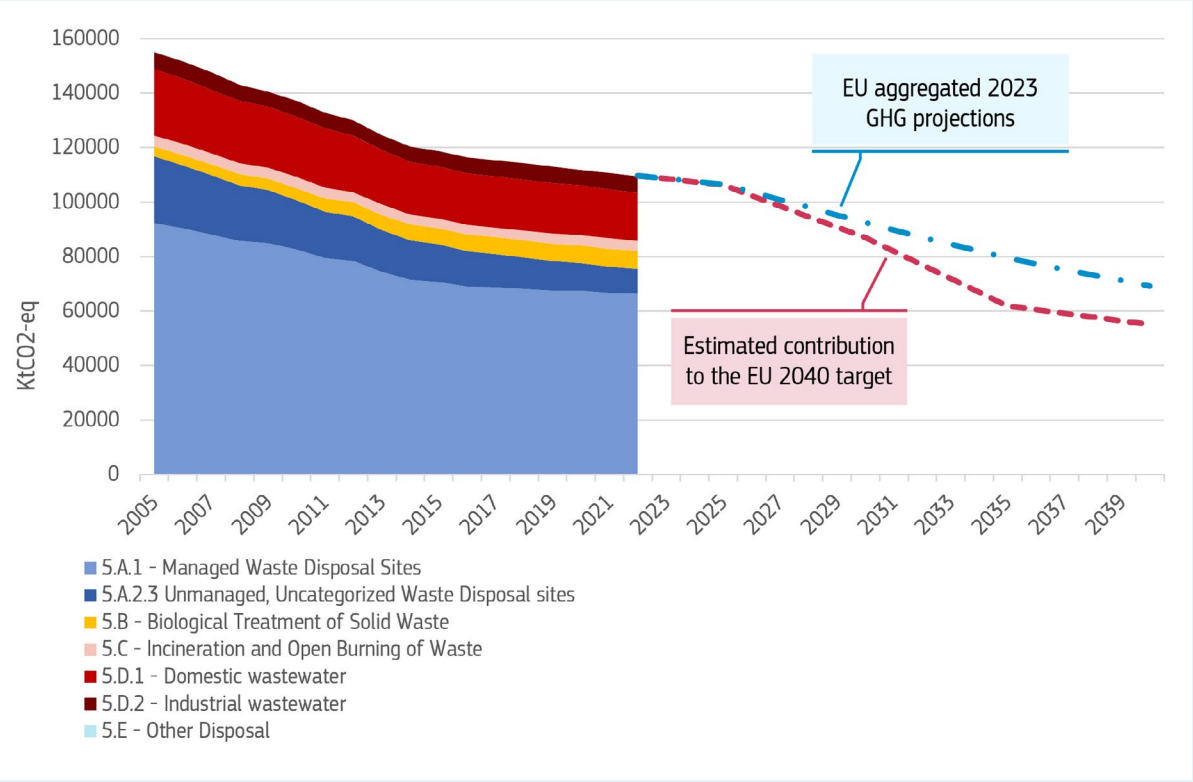
Emissions from energy recovery of waste, processing recycled materials and transporting waste are not reported in the waste sector but in the energy, manufacturing and transport sectors. Therefore, actual emissions generated by waste are in fact higher than reported waste emissions, which shows its cross-sectoral nature. This box focuses mainly on emissions from the waste sector, other aspects like environmental impacts (natural resources, pollution etc.) are not subject of this text.

2. Waste emissions trends

While the waste sector accounts for a small part of total EU greenhouse gas (GHG) emissions (i.e. about 3% of total GHG emissions and around 5% of the emissions covered by the EU Effort Sharing Regulation) reducing GHG emissions from waste also has positive effects on our lives and a better use of waste as a resource (by substituting virgin raw materials) can help reduce emissions in other sectors. In 2022, emissions were 30% below the level of 2005. Over the same period, emissions from solid waste disposal (currently representing more than 2/3 of waste emissions) declined by 35%, while wastewater treatment (close to a fifth of current waste emissions) were down by 23%, with a minor contribution from industrial wastewater (i.e. -5%). Conversely, the emissions from the biological treatment and from the open burning of solid waste have increased (i.e. by 86% and 32%, respectively). Waste sector emissions could decrease further once all current EU waste policies are fully implemented. The speed of reduction should slight increase, from an average annual reduction of around 2.7 $MtCO_2$-eq to 2.9 $MtCO_2$-eq up to 2030 and further increase to 3.2 $MtCO_2$-eq between 2030 and 2040, according to the Commission analysis supporting the Communication on the 2040 target.

70 Source sector CRF5 Waste management in IPCC 2006 Guidelines. Guidelines are available at Publications - IPCC-TFI (iges.or.jp).

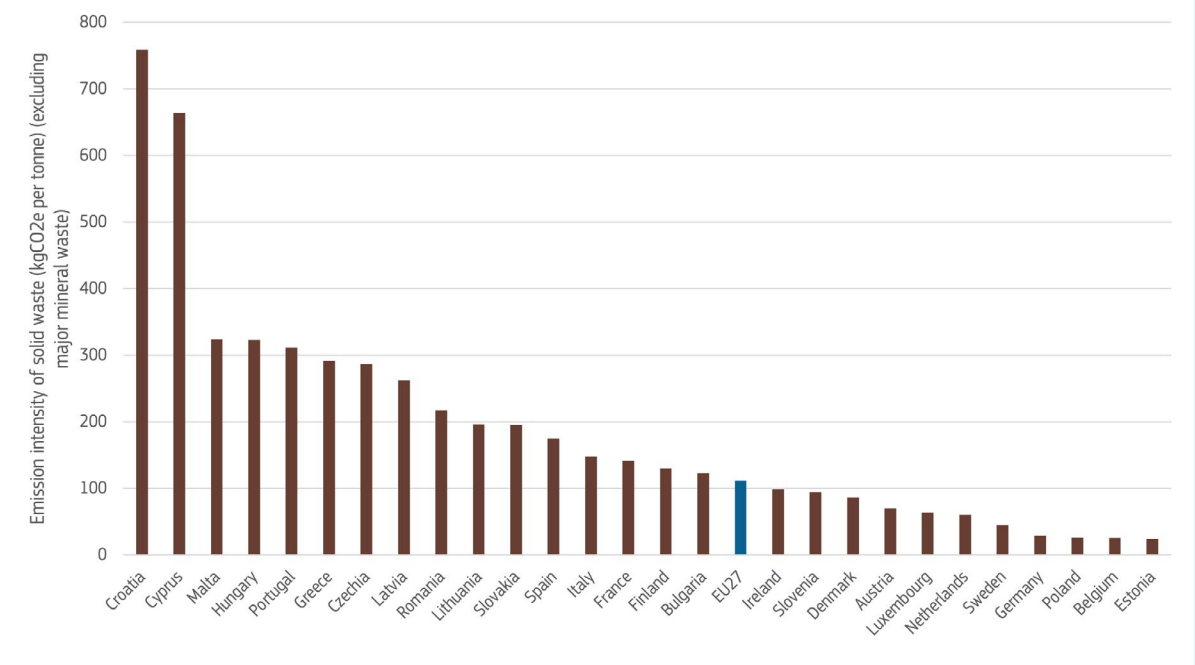
Figure 8.1: EU GHG emissions from waste (2005 to 2022), by subsectors, plus GHG projections up to 2040 and model-based indicative contribution of the waste sector in achieving the EU climate target



3. Behind emissions trends

Emissions from waste are driven not only by waste generation but also by several other underlying factors ranging from the emission intensity and composition of the waste-to-waste treatment methods. First, we can look at emission intensity – emissions per tonne of solid waste. Since there is a strong correlation between emission intensity and total emissions, Members States should focus on the reduction of emission intensity of their waste management systems, bearing in mind that waste prevention and reduction should always be prioritized according to the waste hierarchy. The differences among Member States are substantial (see **Figure 2**). Croatia produces nearly seven times more GHG emissions per tonne of solid waste than the EU average. On the other hand, Estonia, Belgium, and Poland produce less than a quarter of the EU average.

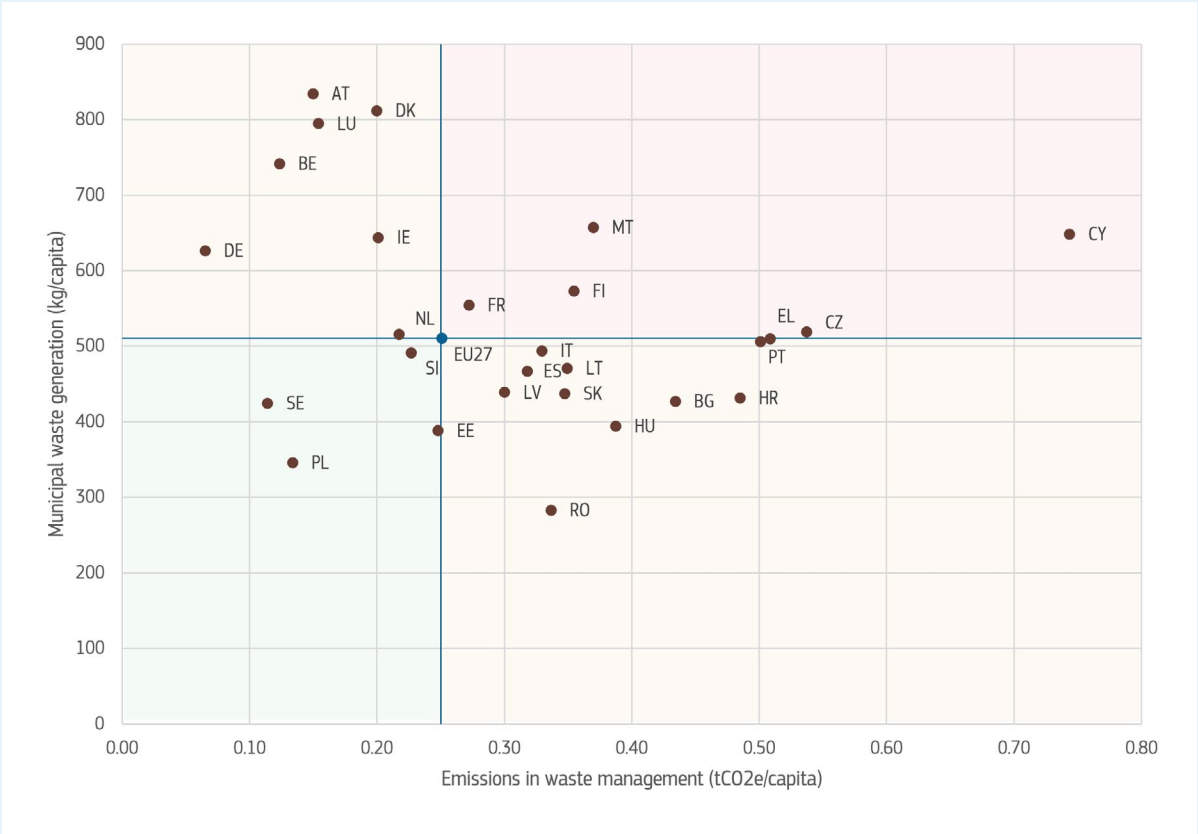
Figure 8.2: Emission intensity of solid waste ($kgCO_2e$/tonne) (average 2017-2021)



A similar picture is visible if we look at GHG emissions per capita. Again, emissions per capita show visible differences. Cyprus emits three times more GHG per capita than EU average and eleven times more than Germany, which has the lowest emissions. On this matter, the EEA concludes that waste sector GHG emissions would decrease by 53% from the 2021 level if all Member States reduce their emissions just to the average per-capita emissions of five best performing countries (Germany, Sweden, Belgium, Poland and Austria).

If we combine emission intensity with waste generation, we get another interesting insight: there is no clear correlation between these two metrics (see Figure 8.3). Member States with the highest municipal waste production (Austria, Denmark) have below-average emissions. This indicates that despite the high volume of waste, their waste management is very effective in terms of GHG emissions. On the other hand, low volume of waste does not necessarily mean low emission. Romania could be a good example of this – it has the lowest municipal waste production, but emissions are above the EU average.

Figure 8.3: Emissions in waste management and municipal waste generation



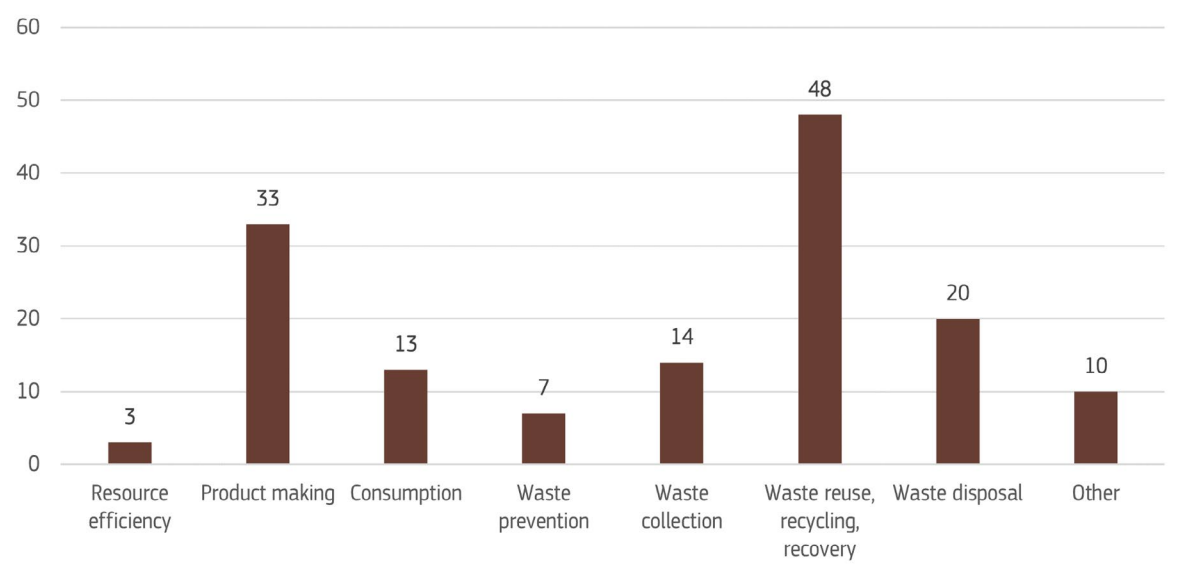
4. Policies and measures

In addition to and in implementation of relevant European directives such as the Waste Framework Directive, the Industrial Emissions Directive, and the Landfill Directive, EU Member States reported over 200 policies and measures related to the waste sector in 2023. These measures focus on various parts of the waste chain, including waste prevention, preparation for reuse, recycling, energy recovery, and, to a lesser extent, disposal; and were mostly linked to municipal waste and organic waste types - which are mostly linked with generating emissions from landfills and biological treatment.

Regulatory policies are the most commonly reported by Member States and most are linked to EU policy – specially the Waste Framework Directive and Landfill Directive; reflecting the substantial regulatory requirements in EU waste policy to be met by countries.

Only 15% of waste sector policies and measures have been reported with impact data (i.e., how effective they were at reducing GHG emission). Nearly all policies with impact data refer to the reduction of emissions from landfills. Furthermore, when comparing historical GHG emission data with implemented policies, there was a correlation between countries that had introduced landfill bans on landfilling biodegradable waste and achieving the largest waste sector emission reductions. Ireland is the only exception to this. It has a high landfill tax and targets specific waste streams through a national waste prevention programme while also achieving high emission reduction.

Figure 8.4: Number of reported policies and measures by category (EU, 2023)



5. Circular economy in the spotlight

The emissions reported under the waste sector focus on the direct reduction of emissions linked to less waste and better waste management. However, the emission reduction potential of a more circular economy – where the value of products and materials is retained for as long as possible – goes beyond just the waste sector.

The circular economy could reduce demand for virgin materials and thus reduce emissions of extraction and processing of these materials. However, emissions from these activities are reported under industry[71]. On the other hand, a higher share of renewable energy could reduce the impacts of energy-intensive parts of the circular economy such as material waste recovery. Total emissions can only be reduced through coordinated policies along the whole value chain from design, production, consumption, and waste reuse. The circular economy has a cross-cutting character and is therefore considered a prerequisite for climate neutrality in the Circular Economy Action Plan[72].

The cross-cutting character has one significant difficulty. As indicated in the previous section, the potential emission reductions due to circular economy measures are usually unquantified, hidden, or poorly captured in the reporting of policies and measures for reducing GHG emissions (only 6% of reported policies are considered circular economy-related). For example, if glass waste is collected and processed into recyclables and used as secondary raw material in producing new glass, then the glass industry needs less energy than that used for producing the same glass from virgin materials. However, such processes are seldom reported as circular economy measures in the relevant manufacturing sector and their potential might be underestimated. Moreover, realising such potential requires collaboration along the whole value chain and across sectors.

In addition to the challenges faced by the cross-sectoral nature of circular economy-related policies and measures is their cross-border nature: materials consumed in one country may have been extracted in another. Therefore, the benefits of circular actions - from an emissions perspective - may not be entirely taking place within the national entity implementing the policy or measure. Consumption-based emission accounting can track how policies and measures effect GHG emissions across entire value chains and national entities. However, as international reporting focus on territorial-based emissions, it is not appropriate to incorporate this new logic into regular reporting. Nevertheless, to understand the full benefits of the circular economy in policy making it is an important additional step for Member States to undertake in their national policy assessments.

Sources: EEA. Briefing no. 25/2023. Capturing the climate change mitigation benefits of circular economy and waste sector policies and measures EN HTML: TH-AM-24-002-EN-Q - ISBN: 978-92-9480-626-0 - ISSN: 2467-3196 - doi: 10.2800/512574.

71 Source sector CRF2 Industrial processes and product use in IPCC 2006 Guidelines. Guidelines are available at Publications - IPCC-TFI (iges.or.jp).
72 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM/2020/98 final

9. LULUCF

The revised **LULUCF regulation** sets two compliance periods:

- From 2021 to 2025: the assessment of Member States' progress is based on 'accounted' emissions and removals in the land sector, taking into account historical benchmarks for land use activities, such as the Forest Reference Level for sustainable forest management. Across all land categories, a Member State has to fulfil the 'no-debit' rule, meaning that the 'accounted' emissions do not exceed 'accounted' removals. If a Member State shows more accounted emissions than accounted removals, it has a 'debit' and is therefore not in line with the 'no-debit' rule. Conversely, if a Member State shows more accounted removals than accounted emissions, it has a 'credit' and therefore meets the 'no-debit' rule requirement. If the 'no-debit' rule is not met in a Member State, it will be able to use a number of flexibilities to compensate for the net debit (e.g. by purchasing credits from other Member States). If a net debit remains from the first compliance period, even after using all flexibilities, this debit will be moved to the ESR account of the Member State.
- From 2026 to 2030: the reporting rules are simplified and are based on the sum of reported emissions and removals in all land categories, with the historical benchmarks completely abolished. The revised EU target requires that the EU increases its land-based net removals by additional -42 $MtCO_2eq$ by 2030 as compared to the yearly average of the period 2016-2018. This target is then distributed among Member States by means of binding national targets for 2030 in a way that requires each Member State to increase their ambition in national agriculture and forestry policies[73].

There are several **flexibilities** Member States can make use of under the LULUCF Regulation. The **general flexibilities** include the flexibility with the ESR, as well as transfers of LULUCF surpluses among Member States. If a Member State fails to meet its LULUCF target or budget, it can deduct annual emission allocations under ESR and transfer them to LULUCF, up to the amount required to meet its target. If a Member State outperforms its LULUCF target and budget, it can transfer its LULUCF surplus to another Member State.

For the period 2021 to 2025, specifically, Member States have access to the **managed forest land flexibility mechanism**, subject to the EU as a whole meeting the 'no-debit' commitment. Member States can compensate excess accounted emissions from forest land provided they include measures to ensure conservation or the increase in forest sinks in their long-term strategies under the Governance Regulation, or they provide evidence of natural disturbances and plan measures to prevent or mitigate similar events in the future.

For the period 2026 to 2030, in addition to the general flexibilities, the **land use mechanism** can be used by Member States that do not meet their target, subject to the EU, as a whole, meeting its 2030 target. This includes compensation for natural disturbances as well as a flexibility due to the negative effects of long-term effects of climate change or the negative effects of an exceptionally high proportion of organic soils on land removals.

73 Handbook on the updated LULUCF Regulation EU 2018/841 - Guidance and orientation for the implementation of the updated regulation - Version 2 (europa.eu)

Table 9.1: LULUCF accounted emissions and removals for 2021 and 2022 (2023 submission per Member State and land category), in $ktCO_2eq$[74]

Member State	Forest Management	Deforested Land	Afforested Land	Cropland Management	Grassland Management	Wetlands	Total 2021+2022
AT	-8 088.9	2 650.9	-2 829.9	908.4	- 656.0		-8 015.5
BE	- 465.3	1 509.6	- 611.1	390.3	- 170.9		652.5
BG	-8 300.6	100.8	- 482.8	844.9	2 159.4		-5 678.4
CY	97.1	16.3	- 35.5	- 6.8	14.0		85.1
CZ	23 749.1	505.1	-1 129.7	- 57.9	- 305.4		22 761.2
DE	-21 887.8	1 308.1	303.6	- 164.1	-7 156.0	- 135.2	-27 731.4
DK	-5 537.6	303.5	-2 679.4	-5 932.4	109.4		-13 736.5
EE	83.2	671.2	- 509.3	1 242.3	177.7		1 665.2
ES	-3 678.6	2 704.6	-19 448.8	-7 538.7	178.9		-27 782.7
FI	17 329.4	5 486.8	- 32 8.1	1 851.4	- 143.2		24 196.4
FR	62 049.7	28 422.2	-23 117.2	-15 765.2	4 053.0		55 642.5
GR	685.3	89.0	- 85.0	-1 364.4	-3 333.0		-4 008.1
HR	-2 867.3	48.9	- 479.0	20.3	- 233.8		-3 510.9
HU	-8 503.3	622.4	-2 204.0	734.3	366.1		-8 984.6
IE	828.0	382.2	-6 195.0	- 219.3	- 758.8	-2 403.9	-8 366.8
IT	-7 400.5	3 938.5	-8 438.6	- 162.0	4 299.1		-7 763.7
LT	-3 111.0	148.6	-2 399.2	-3 024.1	1 505.1		-6 880.6
LU	- 474.9	29.6	- 21.4	- 72.9	53.5		- 486.1
LV	-3 090.5	2 427.1	- 445.9	127.6	- 144.4		-1 126.1
MT	0.1	- 0.7	- 0.3	- 14.9	1.6		- 14.3
NL	916.3	1 653.4	-1 297.5	-2 011.1	-2 077.6		-2 816.5
PL	-5 502.7	3 741.4	-3 556.3	-1 510.5	354.4		-6 473.8
PT	20 681.7	1 903.5	-3 110.9	-1 338.4	-2 750.9		15 384.9
RO	-10 243.6	2 318.6	-3 101.9	-26 134.8	-7 860.0		-45 021.8
SE	-18 700.2	5 335.6	-1 144.8	577.5	335.3		-13 596.7
SI	6 157.2	649.4	- 254.6	- 66.5	208.0		6 693.5
SK	-3 061.8	115.9	- 683.1	- 181.4	504.7		-3 305.7
EU							-68 218.9

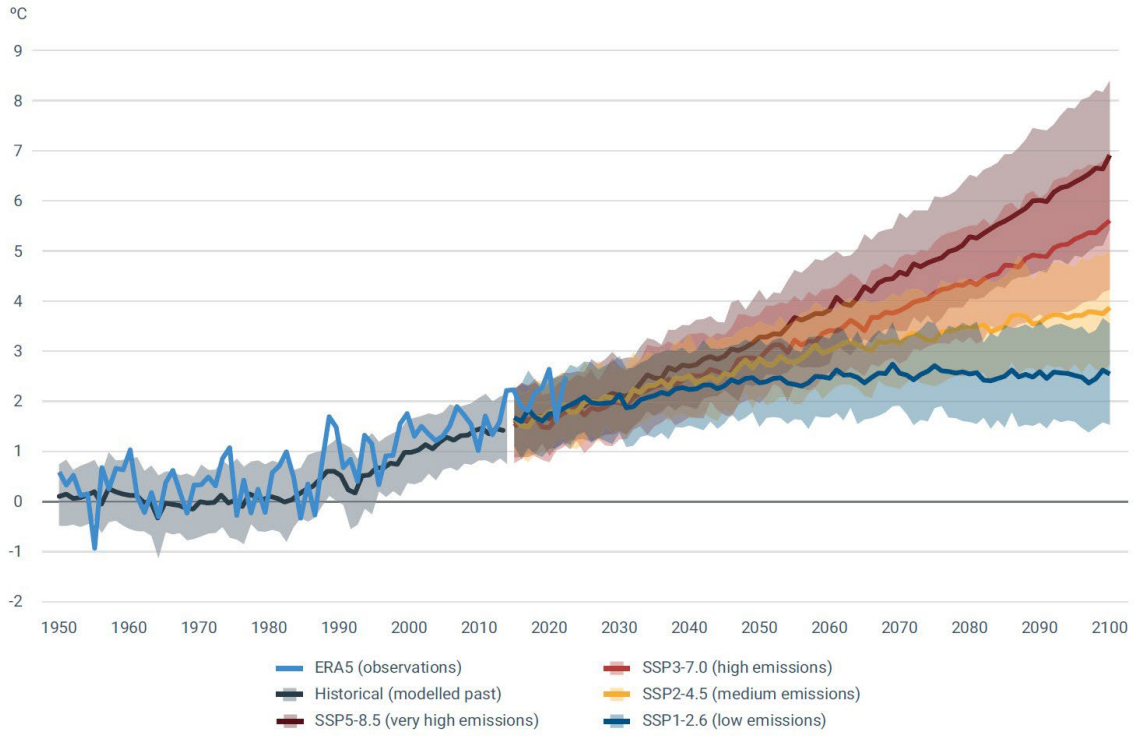
74 Computation of the accounting status for each Member State and the EU. The method continued the approach applied under the Kyoto Protocol period (2013 to 2020). However, the accounting approach for the period 2021 to 2025 is new and differs from the Kyoto exercise. The accounting follows the specifications laid out in Regulation 2018/841: Article 2, 4, 5, 6, 7 8 and 9. The input data for this analysis has been extracted from the EU Greenhouse Gas Inventory Report 2024 for 1990-2022 based on final Member States' inventory submissions under the EU Governance Regulation (GHGI). The computation of accounting results combines the relevant data from the final GHGI in accordance with the rules laid out in the above articles (Reported data for the years 2005 to 2009 and 2021-2022, from Section 4 of the GHGI). This analysis provides an approximate estimate of the status of a Member State's trend towards compliance with its article 4(1) commitment. It also provides a collective status of achievement of the article 4 commitment, an element that is needed to determine if the flexibility through article 13 of the regulation is available (See Regulation 2018/841 Art 13(2)(b)). Numbers in table rounded up. Calculations cover emissions and removals of the greenhouse gases listed in Section A of Annex I to Regulation 2018/841

10. Preparedness for and resilience to climate impacts

10.1 European Climate Risk Assessment (EUCRA)

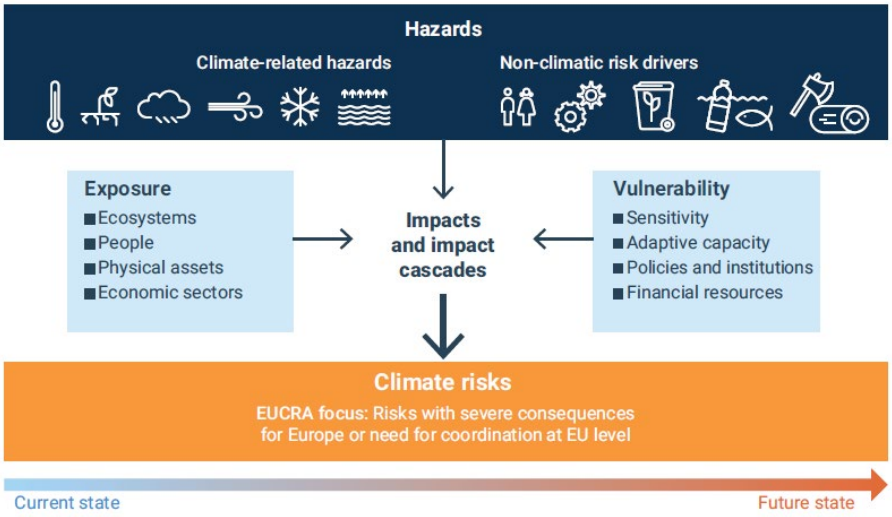
Climate hazards will continue to increase in the coming decades and beyond due to the inertia of the climate system, even if ambitious global emission cuts reduce the potential damage. In the best-case scenario where we limit global warming to 1.5 degrees above pre-industrial levels, Europe will have to learn to live with climate that is 3 degrees warmer, and consequently cope with exponentially more heatwaves and other weather extremes.

Figure 10.1: Observed and projected temperature increase over European land area



The fact that climate hazards interact with non-climatic risk drivers underlines the need for systems-approaches.

Figure 10.2: Methodological framework of EUCRA[75]



75 Source: EEA.

Granular assessment of changes in climate impact drivers is the basis for considering climate risks.

Table 10.1: Projected change in climate impact drivers in Europe

Table 2.3 Projected change in climate impact drivers in Europe

		Northern Europe		Western Europe		Central-eastern Europe		Southern Europe	
		SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)
Heat and cold	Mean temperature	↑	↑↑	↑	↑↑	↑	↑↑	↑↑↑	↑↑↑
	Cooling degree days	↑	↑↑	↑↑	↑↑↑	↑↑	↑↑↑	↑↑↑	↑↑↑
	Heating degree days	↓	↓↓	↓	↓↓	↓	↓↓	↓↓	↓↓↓
	Frost days	↓	↓↓↓	↘	↓	↓	↓	↓	↓↓
	Daily minimum temperature	↑	↑↑↑	↑↑	↑↑↑	↑	↑↑	↑↑↑	↑↑↑
	Daily maximum temperature	↑	↑↑	↑	↑↑	↑	↑↑	↑↑↑	↑↑↑
	Heatwave days	↑↑↑	↑↑↑	↑↑	↑↑↑	↑↑↑	↑↑↑	↑↑↑	↑↑↑
Wet and dry	Total precipitation	↗	↗	⤭	⤭	⤭	⤭	↘	↘
	Heavy precipitation (1 day)	↗	↑	↗	↑	↗	↗	↗	↗
	Heavy precipitation (5 days)	↗	↗	↗	↗	↗	↗	⤭	⤭
	Consecutive dry days	⤭	↗	↗	↗	↗	↗	↗	↗
	Meteorological drought	↘	↘	⤭	⤭	⤭	↘	↗	↗
	Agricultural drought	⤭	↘	↗	↗	↗	↗	↑	↑
Wind	Mean wind speed	↘	↘	↓	↘	↓	↓	↘	↘
Snow and ice	Snowfall	↓	↓	↘	↓	↘	↓	↘	↓

	Baltic Sea		Black Sea		Mediterranean Sea		North-east Atlantic Ocean	
	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)	SSP1-2.6 (low emissions)	SSP3-7.0 (high emissions)
Acidity (pH) of seawater	-0.09	-0.15	-0.08	-0.13	-0.08	-0.12	-0.1	-0.15
Sea ice cover	-2.3	-3.2	0	0	0	0	-2.5	-3
Sea surface temperature	1.1	1.6	1.1	1.4	0.9	1.3	0.6	0.9
Relative sea level rise	0.05	0.07	0.19	0.2	0.22	0.24	0.18	0.19

High agreement: at least 80% of models of each ensemble show a positive change

Low agreement: at least 50% of models of each ensemble show a positive change

No agreement: ensembles disagree on the direction of change

Low agreement: at least 50% of models of each ensemble show a negative change

High agreement: at least 80% of models of each ensemble show a negative change

↑↑↑ increase above 3 standard deviations

↑↑ increase above 2 standard deviations

↑ increase above 1 standard deviation

↗ increase above 0.25 standard deviations

⤭ limited change between 0.25-0.25 standard deviations

↘ decrease below -0.25 standard deviations

↓ decrease below 1 standard deviation

↓↓ decrease below 2 standard deviations

↓↓↓ decrease below 3 standard deviations

Notes: Summary of confidence in the direction of projected change in climate impact drivers (colour coding), representing their aggregate characteristic changes for mid-century (2041-2060, in reference to the period 1995-2014) for ensemble-scenario combinations CMIP6 SSP1-2.6, CMIP5 RCP2.6, CORDEX-EUR (0.11°x0.11°) RCP2.6 and CMIP6 SSP3-7.0 within each EUCRA region. Arrows shown are based on detrended standard deviation (1995-2014) multiples and on median changes of the CMIP6 ensemble. A standard deviation of 0.25, 1, 2, 3 corresponds to a moderate, strong, very strong, severe increase/decrease in the text. Values shown are ensemble median changes, except for sea level rise which are ensemble mean changes. Ensemble agreement is not available for sea level rise. Underlying climate variables are: heatwave days (days with bias-adjusted maximum temperatures above 35°C), meteorological drought (standardised precipitation index for 6 months cumulation period), agricultural drought (standardised precipitation evapotranspiration index for 6 months cumulation period).

Source: Author's compilation based on data from C3S, 2023h.

A structured risk assessment considers climate hazards, exposure and vulnerability, as well as policy readiness.

Table 10.2: Risk assessment for 36 major climate risks for Europe[76]

Climate risks	Urgency to act	Risk severity			Policy characteristics		
		Current	Mid-century	Late century (low/high warming scenario)	Policy horizon	Policy readiness	Risk ownership
Ecosystems							
Coastal ecosystems	Urgent action needed	+++	+++	+++	Medium	Medium	Co-owned
Marine ecosystems	Urgent action needed	+++	+++	++	Medium	Medium	EU
Biodiversity/carbon sinks due to wildfires (hotspot region: southern Europe)	Urgent action needed	+++	++	++	Medium	Medium	Co-owned
Biodiversity/carbon sinks due to wildfires	More action needed	+++	++	++	Medium	Medium	Co-owned
Biodiversity/carbon sinks due to droughts and pests	More action needed	+++	++	++	Long	Medium	Co-owned
Species distribution shifts (*)	More action needed	+++	++	++	Medium	Medium	Co-owned
Ecosystems/society due to invasive species	More action needed	+++	++	++	Medium	Medium	Co-owned
Aquatic and wetland ecosystems	More action needed	+++	++	++	Medium	Medium	Co-owned
Soil health (*)	More action needed	+++	++	++	Medium	Medium	Co-owned
Cascading impacts from forest disturbances	Further investigation	+	+	+	Long	Medium	Co-owned
Food							
Crop production (hotspot region: southern Europe)	Urgent action needed	+++	++	++	Short	Medium	Co-owned
Crop production	More action needed	+++	++	++	Short	Medium	Co-owned
Food security due to climate impacts outside Europe (*)	Further investigation	++	++	+	Short	Medium	EU
Food security due to higher food prices	Further investigation	++	+	+	Short	Medium	Co-owned
Fisheries and aquaculture	Further investigation	++	+	+	Short	Medium	Co-owned
Livestock production	Watching brief	++	++	+	Short	Medium	Co-owned
Health							
Heat stress – general population	Urgent action needed	+++	+++	+++	Long	Medium	National
Population/built environment due to wildfires (hotspot region: southern Europe)	Urgent action needed	+++	+++	+++	Medium	Medium	Co-owned
Population/built environment due to wildfires	More action needed	+++	++	++	Medium	Medium	Co-owned
Wellbeing due to non-adapted buildings (**)	More action needed	++	++	++	Long	Medium	Co-owned
Heat stress – outdoor workers (hotspot region: southern Europe)	More action needed	+++	+++	+++	Short	Medium	Co-owned
Heat stress – outdoor workers	Sustain current action	+++	+++	+++	Short	Medium	Co-owned
Pathogens in coastal waters	Further investigation	+	+	+	Medium	Medium	Co-owned
Health systems and infrastructure	Further investigation	+++	++	++	Medium	Medium	National
Infectious diseases	Sustain current action	+++	++	++	Short	Advanced	Co-owned

Climate risks	Urgency to act	Risk severity			Policy characteristics		
		Current	Mid-century	Late century (low/high warming scenario)	Policy horizon	Policy readiness	Risk ownership
Infrastructure							
Pluvial and fluvial flooding	Urgent action needed	+++	+++	++	Long	Medium	Co-owned
Coastal flooding	More action needed	+++	+++	+++	Long	Advanced	Co-owned
Damage to infrastructure and buildings (**)	More action needed	++	++	++	Long	Medium	Co-owned
Energy disruption due to heat and drought (hotspot region: southern Europe)	More action needed	++	++	++	Medium	Medium	Co-owned
Energy disruption due to heat and drought	Further investigation	++	++	+	Medium	Medium	Co-owned
Energy disruption due to flooding	Further investigation	++	++	++	Long	Advanced	Co-owned
Marine transport	Further investigation	++	++	++	Medium	Medium	Co-owned
Land-based transport	Further investigation	++	++	++	Medium	Medium	Co-owned
Economy and finance							
European solidarity mechanisms	Urgent action needed	+++	++	++	Short	Medium	Co-owned
Public finances	More action needed	++	++	++	Medium	Medium	Co-owned
Property and insurance markets	More action needed	++	++	++	Medium	Medium	Co-owned
Population/economy due to water scarcity (hotspot region: southern Europe)	More action needed	++	++	++	Medium	Medium	Co-owned
Population/economy due to water scarcity	Further investigation	++	++	++	Medium	Medium	Co-owned
Pharmaceutical supply chains (*)	Further investigation	++	+	+	Short	Medium	EU
Supply chains for raw materials and components (*)	Further investigation	++	++	++	Short	Medium	EU
Financial markets	Further investigation	+	+	+	Short	Medium	Co-owned
Winter tourism	Sustain current action	+++	+++	++	Medium	Advanced	National

Legends and notes

Urgency to act
- Urgent action needed
- More action needed
- Further investigation
- Sustain current action
- Watching brief

Risk severity
- Catastrophic
- Critical
- Substantial
- Limited

Confidence
Low: +
Medium: ++
High: +++

(*) Wide range of evaluations by authors and risk reviewers.
(**) Urgency based on high warming scenario (late century).

Source: EEA.

76 Source EEA

EUCRA risk assessments make it possible to identify key considerations for EU policies.

Table 10.3: EU policies with high adaptation potential, based on their links to major climate risks[77]

EU policies with high adaptation potential	No. of major risks linked to policy
Biodiversity strategy for 2030	11
Critical Entities Resilience Directive	9
Proposed nature restoration law (not yet adopted)	8
Farm to fork strategy	8
Common agricultural policy	8
Union Civil Protection Mechanism	8
Water Framework Directive	7
Birds Directive and Habitats Directive	7
Forest strategy	7
Floods strategy	6
Renovation wave	6
Energy Performance of Buildings Directive and Energy Efficiency Directive	6
Corporate Sustainability Due Diligence Directive	5
Corporate Sustainability Reporting Directive	5
EU4Health	5
EU Solidarity Mechanism: Social Cohesion Fund	5
Marine Strategy Framework Directive	4

Note: this table includes legal instruments (e.g. EU directives), non-legal instruments (e.g. strategies) and funding mechanisms, based on their mentions in EUCRA factsheets and storylines.

10.2 The EU Mission on Adaptation to Climate Change

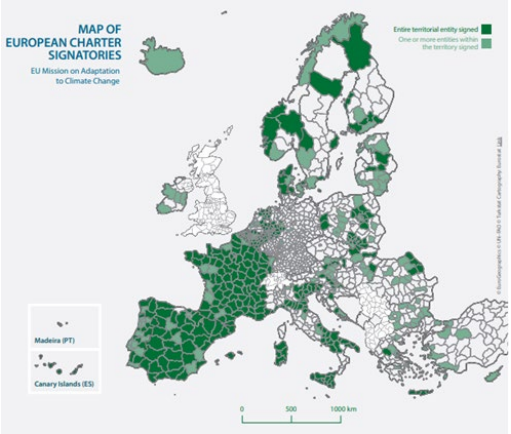
In the face of unprecedented challenges posed by climate change, the EU has embarked on an ambitious journey towards a sustainable and resilient future. The EU Mission on Adaptation to Climate Change under Horizon Europe, the EU's key funding programme for research and innovation, is a significant pillar in this transformative endeavour. Supporting European regions, cities, and local authorities in their efforts to build resilience against the impacts of climate change, the Mission aims to support at least 150 European regions and communities in their work to achieve climate resilience by 2030.

The Mission provides broad support to European regions, local authorities, and communities in preparing and planning climate resilience solutions. This support includes the Mission Portal, an online platform which provides data, knowledge, and decision-making support; showcases success stories; and informs on webinars, news and events related to the Mission.

77 Source: EEA.

Mission Charter signatories

EU countries, regions and cities have an essential role to play in implementing the Mission, because they are key agents of change in deploying new technologies and experimenting innovative solutions that address regional and local needs. Regional and local authorities that share the Mission's ambition have signalled their interest in signing the Mission Charter and joining the Mission. They have declared their interest and readiness to cooperate, mobilise resources and develop activities in their respective region and communities to achieve their adaptation goals.



Other entities, such as research institutions, academics, practitioners, or businesses, have been invited to endorse the Charter and join the Mission's network of organisations working together towards climate resilience as Friends of the Mission.

The 311 signatories of the Mission Charter as of autumn 2024 include: 294 EU regions and local authorities from 25 EU Member States; and 17 regions and local authorities from Horizon Europe's Associated Countries. There are an additional 63 Friends of the Mission.

Mission projects

The Charter signatories, Friends of the Mission and wider European regions and local authorities are supported by 43 Mission-funded projects and well over 100 Mission-related projects. These projects are at the forefront of research and development in innovative climate adaptation and resilience approaches. They go beyond theory by delivering practical and tangible outcomes through guidance, tools, data, and on-the-ground experimentation, and by implementing solutions identified in the Mission case studies. By providing essential resources through its centralised implementation platform, MIP4Adapt[78], and the Mission projects, the Mission empowers regional and local authorities to accelerate their climate preparedness.

Project CLIMAAX - Better understanding climate risk at the regional level[79] :

> The EU-funded CLIMAAX project embodies the urgency of supporting cities and regions in carrying out accurate risk assessments as this is critical to building up the EU's resilience to climate change. Many European regions and communities have limited experience in and resources for integrating the available local and global data, models and concepts into context-specific climate risk assessments. The CLIMAAX project addresses this issue.

78 https://climate-adapt.eea.europa.eu/en/mission/the-mission/about-mip4adapt
79 www.climaax.eu

A toolbox for climate resilience

The project is built on three key elements:

- a framework for regional risk assessments, which can be applied anywhere and takes into account diverse conditions and challenges on the ground;
- a free, open and pan-European toolbox designed to enable regions to access European data sets and overlay these with their own local data; and
- funding to carry out regional risk assessments, using CLIMAAX tools.

Project RESIST - Accelerating the delivery of climate adaptation solutions[80]:

> Every city faces its own unique climate risks. By pairing regions across Europe, the EU-funded RESIST project aims to share best practices and solutions for building resilience against climate change impacts. The impact of climate change is already being felt: from flooding in Spain to wildfires in Greece and scorching heatwaves across much of Europe. The RESIST project is focused on providing climate change solutions geared towards specific regions, cities and local authorities, which each have their own unique socio-economic profile and are facing climate-related challenges such as floods, droughts, heatwaves, wildfires and soil erosion.

Multistranded approach

The project applies the 'quintuple helix' innovation model, which emphasises the role of interactions between academia, business, government, citizens and the environment. The project's management is confident that this approach will result in over 100 new and innovative climate adaptation solutions being developed during the project. The innovations, which will be developed with the support of the project's research and industry partners, will be tested in four EU regions: South-West Finland, Central Denmark, Catalonia and Central Portugal. The knowledge and adaptation pathways tested in these leading regions will then be transferred to eight twinned regions through mutual-learning activities and digital twins.

Mission solutions

Mission solutions support regions and local authorities in their adaptation work. Regional and local authorities need to quickly identify, plan and implement relevant adaptation measures to combat the impact of climate change. Some measures may need to be implemented over many years due to their scope and scale and the time they may take to deliver benefits (as illustrated by the length of time it takes for a tree to grow and cast shade). The Adaptation Stories showcase the successful implementation of climate adaptation solutions in regions of Europe that other regions may wish to replicate. They demonstrate the power of cooperation and innovative approaches to addressing climate challenges and creating a more resilient and sustainable future for Europe. The European Commission Risk Data Hub, supports the implementation of the Mission on Adaptation, through serving as a centralized platform for collecting, harmonizing, and disseminating regional climate related hazard, loss and risk data.

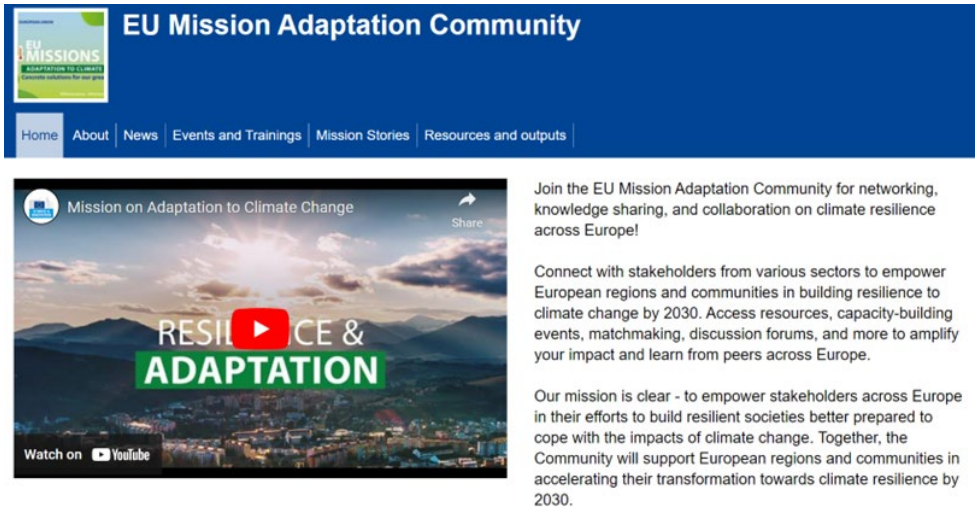
10.3 Adaptation stories

The Adaptation Stories[81] showcase real-life examples of regional or local actions and good practices in planning, funding, implementing, and monitoring climate adaptation solutions. They are intended to inspire others to act on climate adaptation - an example: Zagreb where green infrastructure and nature-based solutions have been deployed widely to deal with heat waves in the context of urbanisation and climate change

80 https://resist-project.eu
81 Adaptation Stories (europa.eu)

10.4 The EU Mission Adaptation Community

The Mission's Community of Practice[82] facilitates the exchange of knowledge and experiences and strengthens coordination and collaboration between diverse adaptation practitioners. Its membership comprises regional and local authorities that are Charter signatories; Mission projects; regional and local authorities participating in the implementation of Mission projects; the Commission and other EU institutions; national authorities; and Friends of the Mission[83].



11. Commission's assessment of long-term strategies

Stable long-term strategies are a key element in the preparation of the economic transformation needed to achieve climate neutrality by 2050. Long-term strategies show the opportunities for transforming our economy, allow the national discussions to mature, build trust within our society and send clear signals to guide investors while raising awareness and ownership of the transformation needed.

The **Governance Regulation**[84] sets out a process for the Member States to prepare, by 1 January 2020, their first long-term strategies with a perspective of at least 30 years, and new strategies by 1 January 2029 and every 10 years thereafter. Where necessary, Member States should update those strategies every five years.

Since 2021, in line with Article 15(9) of the Governance Regulation, the Commission has regularly assessed whether the national long-term strategies are adequate for the collective achievement of the objectives and targets of the Energy Union and provide information on any remaining collective gap. The main conclusions and the relevant analysis have been included in the staff working document accompanying the annual Climate Action Progress Reports. In its last assessment (2023 Climate Action Progress Report)[85] the Commission concluded that:

> *'Whereas most of the national strategies received to date reflect the ambition to be climate neutral by 2050, they do not yet allow to conclude that the long-term strategies are adequate for the collective achievement of the objectives and targets of the Energy Union. A rough estimate based on the submitted national long-term strategies [...] points to a reduction of GHG emissions of around 85% by 2050 for the EU as a whole. [...] Providing more detailed information on any remaining collective gap would have required a more complete and detailed set of strategies. Member States are therefore encouraged to consider updating and, where needed, to increase both the ambition and the quality of their national long-term strategies.'*

The Commission has also enforced the EU law against failure to submit national long-term strategies. In September 2022, in view of the substantial delay of Bulgaria, Ireland, Poland and Romania in notifying their national long-term strategies under the Governance Regulation, the Commission opened formal infringement proceedings and sent letters of formal notice to these countries[86]. The proceedings have since been closed for Bulgaria, Ireland and Romania[87], following the submission of their strategies, but the

82 https://futurium.ec.europa.eu/en/eu-mission-adaptation-community
83 Other useful links: https://climate-adapt.eea.europa.eu/en/mission https://climate-adapt.eea.europa.eu/en/mission/news/news/eu-mission-on-adaptation-to-climate-change-releases-new-report-showcasing-progress-and-priorities
84 Article 15 of Regulation (EU) 2018/1999.
85 https://climate.ec.europa.eu/document/download/60a04592-cf1f-4e31-865b-2b5b51b9d09f_en
86 On 22 September 2022, the Commission sent letters of formal notice to Bulgaria (INFR(2022)2086), Ireland (INFR(2022)2088), Poland (INFR(2022)2089) and Romania (INFR(2022)2090) under Regulation (EU) 2018/1999.
87 The infringement proceedings for Ireland and Romania were closed in Decembre 2023 and in February 2024, respectively.

infringement proceeding against Poland is ongoing. The Commission will consider the next steps according to further developments. Based on its reply to the Commission's letter, Poland appears to be intending to submit its long-term strategy by the end of 2024.

Since October 2022, two additional Member States, Ireland and Romania, have submitted their long-term strategy to the Commission[88]. Both strategies define a clear goal of achieving climate neutrality by 2050. Romania's long-term strategy presents alternative scenarios, including a pathway to approach climate neutrality by 2050, although the removal of the remaining 1% (3 $MtCO_2$-eq) of GHG emissions by 2050 is subject to further analysis. In July 2024, Ireland submitted an updated version of its national long-term strategy. This presents more detailed future emissions pathways, including for the agriculture and LULUCF sectors, but also allows flexibility to account for the fact that optimal pathways will evolve over time.

Overall, by October 2024, all the Member States, except Poland, had submitted their long-term strategies required by the Governance Regulation. Of these, 16 Member States[89] clearly expressed their aim to achieve climate neutrality or carbon neutrality[90] by 2050 or before[91]. Others aim to be largely climate neutral[92] or to achieve reductions of 80-95% by 2050. However, only 10 Member States have reported legally binding goals or targets[93]. Two third of the strategies have been supported by quantitative projections based on different modelling scenarios. The associated emissions reductions may be consistent with the delivery of the specified goals, but this is not always clearly stated. Likewise, where a target has been set, it is not always clear if it is legally binding.

The national long-term strategies also provide useful information at sectoral level that allows strengths and remaining challenges to be identified and recognised. However, coverage varies significantly between Member States or there is a lack of details on the precise scope, particularly on the expected role of land use and removals (see Table 11.1). In this respect, it is worth mentioning that the current LULUCF Regulation provides that Member States may use the managed forest land flexibility only if their long-term strategy includes ongoing or planned specific measures to ensure the conservation or enhancement of forest sinks and reservoirs[94].

Table 11.1: Summary of the main features of the national long-term strategies submitted by the EU Member States

Long-term strategies' main features	AT	BE	BG	HR	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	CY	LV	LT	LU	MT	NL	PT	RO	SK	SI	ES	SE
Climate neutrality by 2050 or earlier	x					x		x	x			x	x	x		x	x	x			x	x	x	x	x	x
Modelling projections and scenarios	x		x	x	x	x	x	x	x		x	x	x	x	x				x		x	x	x	x	x	
Emission projections by sectors	x	x	x	x		x	x	x	x			x	x	x	x	x	x		x		x	x	x	x	x	x
Emission removals in LULUCF	x		x			x	x	x	x				x	x	x						x	x	x	x	x	x
Estimated share of renewable	x		x	x		x		x			x	x	x	x	x		x	x		x	x	x		x	x	x
Estimated energy consumption	x		x	x		x		x			x	x		x	x	x					x	x		x	x	
Estimated investment needs			x	x	x		x	x	x		x	x	x			x			x		x	x	x	x	x	
Socio-economic impacts of transition							x	x	x		x	x		x	x	x					x	x	x		x	x
Adaptation Policies and Measures	x	x	x	x	x	x	x		x			x	x	x	x		x	x	x			x	x		x	x
Legally binding long-term goal				x		x	x		x			x	x					x	x	x	x				x	x

Notes: in the case of DK and SK, emission projections by sector, the estimated share of renewable and energy consumption, end in 2040

88 A summary of the submitted strategies can be found in the links below, for Ireland and Romania, respectively: https://ec.europa.eu/clima/sites/lts/lts_ie_summary_en.pdf https://ec.europa.eu/clima/sites/lts/lts_ro_summary_en.pdf.
89 Denmark, Ireland, Spain, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Austria, Portugal, Romania, Slovenia, Slovakia, Sweden and Finland.
90 Neutrality means by definition that residual emissions are compensated by removals, but not all Member States provided the respective share of emission reductions and removals and the level of ambition for actual reductions varies.
91 Finland by 2035 and Sweden by 2045.
92 Germany was aiming to be largely climate-neutral in 2050, but it should be noted that the long-term strategy that it submitted to the Commission in January 2020 was prepared in 2016. According to its Climate Change Act (as amended in July 2021), Germany is now aiming to achieve climate neutrality by 2045.
93 Denmark, Estonia, Ireland, Spain, France, Luxembourg, Hungary, Malta, the Netherlands and Sweden NL. In addition to the information provided in its national long-term strategy, Germany has also enshrined climate targets in legislation.
94 Article 13.2.(a) and 8.1 of the Regulation (EU) 2018/841.

The inclusion of the recommended contents[95] also varies between Member States. There are gaps in needs for research, development and innovation; estimated long-term investment; CO_2 intensity of GDP; and, to a lesser extent, the expected contributions of renewable energy, energy efficiency and agriculture-specific emission reductions (see Table 11.2 for more details)[96].

A rough estimate based on the submitted national long-term strategies and (where data are missing) on other available information[97], points to a reduction in GHG emissions (excluding LULUCF) of around 86% by 2050 for the EU as a whole. This means that roughly 630 $MtCO_2eq$ still needs to be cut or absorbed in order to achieve climate neutrality by 2050[98]. This is a slight improvement compared with last year's assessment and is due to the latest submissions of Ireland and Romania. However, the overall assessment has not changed. The national long-term strategies received to date do not yet make it possible to conclude that they are sufficiently ambitious to ensure the collective achievement of the objectives and targets of the Energy Union.

The assessment presented above more than justifies the need for Member States to update their strategies every 5 years, as indicated by Article 15(1) of the Governance Regulation. The Commission therefore calls on the Member States to update and, where appropriate, increase both the ambition and the quality of their national long-term strategies in the course of 2025.

Table 11.2: Overview of the national long-term strategies submitted by the EU Member States

Country (date of submission)	**Overall LTS goal by 2050**	**Projected GHG emission reductions by 2050** (% change compared with 1990)	**all gases emissions**	**including LULUCF**	**incl. International maritime and aviation International maritime and aviation**	**Share of renewable energy in gross final energy consumption by 2050**	**Projected final energy consumption by 2050** (% change compared with 2005)	**Highlights from investment needs, enabling policies and socio-economic impact**	**Key reporting gaps**
Austria (27/12/2019)	Climate neutrality	(-74%, -84%)	yes	no	yes	(76%, 93%)	(-52%, -38%)	positive impact on GDP and jobs natural and technical sinks needed to reach carbon neutrality	CO_2 intensity of GDP investment needs socio-economic impact
Belgium (02/03/2020)	Different regional goals	(-85%, -87%) (excluding ETS sector)	?	no	no	n.a.	n.a.	investment needs in buildings climate risks for agricultural system address energy poverty	information at national level GHG and CO_2 intensity of GDP emission reductions for ETS and LULUCF
Bulgaria (27/10/2022)	Unspecified	(-78%, -84%)	yes	no	no	(61%, 70%)	(79, 87 TWh)	positive impact on jobs and wellbeing investment need < 15bn up to 2050 technical sinks to reach carbon neutrality	GHG and CO_2 intensity of GDP emission reductions by sub-sector socio-economic impact
Croatia (24/06/2021)	Unspecified	(-57%, -73%)	yes	no	?	(53.2%, 65.6%)	(-25%, -37%)	overall impact on GDP uncertain around 40 000 new green jobs additional investment above 1.5% of GDP	reductions and removals in LULUCF socio-economic impact emission reductions industrial sectors
Cyprus (14/09/2022)	Unspecified	(-28%, -100%)	yes	yes	?	(51%, 95%)	(1996, 1875 Ktoe)	cost of the transition modest to low gradual closure of thermal power plants natural and tech. sinks to reach neutrality	GHG and CO_2 intensity of GDP emission reduction in buildings socio-economic impact
Czechia (20/12/2019)	quantitative GHG emission reduction target	-80%	yes	no	no	n.a.	n.a.	investment peak with expansion of CCS strengthen energy taxation Increase share of nuclear in energy mix	GHG and CO_2 intensity of GDP emission reductions by sector socio-economic impact
Denmark (20/12/2019)	Climate neutrality	n.a.	yes	yes	no	n.a.	n.a.	targets enshrined in law doubling organic farming increase spending in green research	public consultation emission reductions power & buildings socio-economic impact
Estonia (30/12/2019)	quantitative GHG emission reduction target	-80%	yes	no	no	n.a.	n.a.	targets enshrined in law large investment needed in renewable minor impact on GDP and jobs	CO_2 intensity of GDP emission reductions in buildings RES, FEC/PEC targets

95 See Annex IV to Regulation (EU) 2018/1999.
96 For a more detailed assessment of the national long-term strategies submitted by Member States, please refer to DG CLIMA's dedicated website: https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en.
97 Where possible, these estimates use information from the national long-term strategies in a specific order. First, the national targets or (when these are unavailable or unclear) scenario results (i.e. in the case of a range of values, the most ambitious scenario is considered). In the case of national binding targets adopted after the submission of the strategy, updated values have been used (e.g. in the case of Germany). Where data could not be retrieved from their long-term strategies, use was made of information that the Member States submitted to the Commission under another reporting exercise (i.e. the integrated NECPs and/or 2023 GHG projections). Only when national information was not available were data from the 2020 Reference Scenario EU Reference Scenario 2020 (europa.eu) used as a last resort. Overall, three quarters of the 2020 EU GHG emissions are covered by national sourced information. Unfortunately, the aggregated data and analyses are less meaningful for CO_2 removal and energy data, for which there are significant data gaps in the national long-term strategies.
98 This does not include the international maritime and international aviation under the EU law.

Country (date of submission)	**Overall LTS goal by 2050**	**Projected GHG emission reductions by 2050** (% change compared with 1990)	**all gases emissions**	**including LULUCF**	**incl. International maritime and aviation international maritime and aviation**	**Share of renewable energy in gross final energy consumption by 2050**	**Projected final energy consumption by 2050** (% change compared with 2005)	**Highlights from investment needs, enabling policies and socio-economic impact**	**Key reporting gaps**
Finland (22/04/2020)	Carbon neutrality by 2035	(-87.5%, -90%)	yes	no	?	(64%, 80%)	(-16%, -5%)	slightly positive impact on GDP and jobs employment sensitive to arable lands annual investment ~3% of GDP	CO_2 intensity of GDP emission reductions in buildings strategies for related R&D&I
France (12/05/2020)	Carbon neutrality	-83%	yes	no	no	n.a.	n.a.	targets enshrined in law positive impact on GDP annual investment ~3.5% of GDP	GHG and CO_2 intensity of GDP reductions and removals in LULUCF share of renewable energy in 2050
Germany (02/01/2020)	Largely climate neutral	(-80%, -95%)	yes	no	no	n.a.	n.a.	document outdated compared with recent review of the country's target aimed at reaching climate neutrality by 2045	GHG and CO_2 intensity of GDP emission reductions by sector investment & socio-economic impact
Greece (08/01/2020)	Unspecified	(-83%, -95%)	?	?	?	(82%, 114%)	n.a.	increase use of heat pumps (buildings) and biofuel (transport) investment needs EUR 0.1 to EUR 1.1 bn per year	GHG and CO_2 intensity of GDP emission reductions agriculture & waste socio-economic impact
Hungary (21/09/2021)	Climate neutrality	-100%	yes	yes	no	close to 90%	(-30%, -37%) (to 2017)	positive impact on GDP and jobs annual investment ~4.8% of GDP avoided damage and benefits > costs	reductions and removals in LULUCF emission reductions in buildings
Ireland (30/07/2024)	Climate neutrality	n.a.	yes	no	yes	90% (most ambitious scenario)	n.a.	targets enshrined in law investment needs up to EUR 235 bn over 2031-2050 strong focus on adaptation strategies	socio-economic impact FEC/PEC targets
Italy (11/02/2021)	Climate neutrality	(-84%, -87%)	yes	no	no	(85%, 90%)	-49%	slightly negative impact on GDP boost sustainable finance focus on adaptation strategies	emission reductions in waste Investment needs socio-economic impact
Latvia (27/12/2019)	Climate neutrality	-85% (by 2040)	?	yes	?	n.a.	-37% (primary energy consumption)	positive impact on GDP annual investment ~1.4% of GDP creation of new (green) jobs	CO_2 intensity of GDP emission reductions in buildings adaptation policies and measures
Lithuania (23/07/2021)	Climate neutrality	-100% (20% reduction from LULUCF & CCS)	yes	yes	yes	90%	final & primary energy intensity 2.4 times lower than 2017	positive impact on GDP and jobs 4% of GDP invested in R&D&I by 2040 focus on adaptation strategies	public consultation GHG and CO_2 intensity of GDP emission reductions by sector
Luxembourg (04/11/2021)	Climate neutrality	-100% (including LULUCF)	yes	yes	no	100%	n.a.	Support sustainable finance ensure a just transition for citizens and enterprises	emission cuts in 2050 for all sectors reductions and removals in LULUCF estimated investment needs
Malta (21/10/2021)	Unspecified	-82%	yes	no	no	n.a.	n.a.	increased job opportunities improved air quality and health investment in renewables > EUR 2bn to 2050	CO_2 intensity of GDP LULUCF, RES, FEC/PEC targets
Netherlands (18/12/2019)	Quantitative GHG emission reduction target	-95%	yes	yes	no	n.a.	n.a.	net-zero requires large scale CO_2 capture by 2030, limited impact on GDP and jobs increase income disparities	reductions and removals in LULUCF emission reductions in all sectors by 2050 investment needs
Portugal (15/01/2020)	Carbon neutrality	(-85%, -90%)	?	no	?	(86%, 88%)	(-36%, -35%)	positive impact on GDP and jobs annual investment ~1.2% of GDP better air quality	GHG and CO_2 intensity of GDP strategies related to R&D&I adaptation policies and measures
Romania (14/12/2023)	Carbon neutrality	-99% (including LULUCF)	yes	yes	no	86.1%	-30%	positive impact on GDP Investment needs 1.5 times larger REF 100K new green jobs by 2050	Removal of the remaining 1% of GHG emissions in 2050 still subject to analysis
Slovakia (11/03/2020)	Climate neutrality	-80%	?	no	?	n.a.	n.a.	positive impact on GDP negative impact on jobs & wages annual investment ~4.2% of GDP	GHG and CO_2 intensity of GDP emission reductions in buildings LULUCF, RES, FEC/PEC targets
Slovenia (19/07/2021)	Climate neutrality	(-80%, -90%)	?	no	no	at least 60%	at least -33%	positive impact on GDP and jobs additional investment from EUR 66 to EUR 72 bn focus on a climate resilient society	GHG and CO_2 intensity of GDP emission reductions industrial sectors
Spain (11/12/2020)	Climate neutrality	-90%	yes	no	yes	97%	-44%	positive impact on GDP and jobs negative impact on jobs & wages annual investment ~1% of GDP	CO_2 intensity of GDP emission reductions agriculture & waste emission reductions for industrial sectors

Country (date of submission)	Overall LTS goal by 2050	Projected GHG emission reductions by 2050 (% change compared with 1990)	all gases emissions	including LULUCF	incl. International maritime and aviation international maritime and aviation	Share of renewable energy in gross final energy consumption by 2050	Projected final energy consumption by 2050 (% change compared with 2005)	Highlights from investment needs, enabling policies and socio-economic impact	Key reporting gaps
Sweden (19/12/2019)	Climate neutrality by 2045 and negative emissions thereafter	-85% (by 2045)	yes	no	no	n.a.	final energy intensity 50% lower than 2005	limited impact on GDP and jobs better air quality focus on adaptation strategies	GHG and CO_2 intensity of GDP share of renewable energy investment & socio-economic impact

Notes: (1) An 'unspecified' goal refers to cases where the goal was not expressed in clear terms (e.g. 'to approach', 'to move towards', etc.). (2) Germany's long-term strategy, as submitted to the Commission in January 2020, reflects the goal of the Climate Action Plan 2050 adopted in November 2016. According to the Climate Change Act, as amended in July 2021, Germany now aims to achieve climate neutrality by 2045. (3) In April 2021, Denmark submitted an update of its long-term strategy under Article 18(1)(a) and Annex VI(b) of the Governance Regulation. This update is intended to reflect the Danish Climate Act, which was adopted in June 2020; and which sets a near-term target of reducing Denmark's total GHG emissions by 70% by 2030 compared with the 1990 level and sets a long-term target of achieving climate neutrality by 2050 at the latest. (4) Since July 2023, when the Climate Act entered into force, the Netherlands has had a legally binding target of achieving climate neutrality by 2050. (5) Projected GHG emission reductions are all expressed as a percentage change compared with 1990 levels (except for Belgium, Portugal and Slovenia (where reduction rates refer to the 2005 GHG emission levels); Malta (the 2020 level); and France (the 2015 level)) as a target or as the extreme values of the projected range. In Denmark's long-term strategy, projections refer to a scenario with existing measures that are not in line with the goal and have therefore not been reported in the table. (6) '?' means that the long-term strategy does not provide sufficient or clear information on the exact scope of projected GHG emission reductions. In the case of Spain, only international maritime emissions were included in the projections. (7) Where feasible, final energy consumption has been expressed as a percentage change to the 2005 consumption level. (8) Annual investment needs are generally considered as additional to a 'business as usual' (BAU) or 'with existing measures' (WEM) scenario for 2020-2050. (9) Key reporting gaps are meant to provide only a general view of the long-term strategy's completeness and do not distinguish between mandatory and non-mandatory elements.

12. Examples of funding of climate related projects

12.1 Example of project funded by the Innovation Fund

The **Innovation Fund (IF)** is one of the world's largest funding programmes for the deployment of net-zero and innovative technologies in EEA countries. Financed by revenues from the EU Emissions Trading System (EU ETS), the IF is one of the EU's funds for climate policy, focusing on energy, industry and mobility and fostering competitiveness.

The IF aims to create financial incentives for companies and public authorities to invest in cutting-edge, low-carbon technologies and support the EU's transition to climate neutrality. Thanks to the EU ETS and assuming a carbon price of EUR 75/tCO_2, it is estimated that the IF will have around EUR 40 billion available between 2020 and 2030. The IF has already awarded around EUR 6.5 billion to more than **115 innovative projects** through its previous calls for proposals.

1. H2GS: H2 Green Steel[99]

The IF has granted EUR 250 million to a steel plant in Boden in northern Sweden to build a greenfield, integrated, industrial-scale, renewable hydrogen, green iron and green steel plant. The H2 Green Steel (H2GS) project's innovation involves electrifying the entire production process, increasing energy efficiency and replacing coal with renewable hydrogen. It will ultimately reduce CO_2 emissions by up to 95%.

The plant will use fossil-free electricity to produce the renewable hydrogen needed to bring 5 million tonnes (Mt) of high-quality green steel to the market by 2030. The process involves converting iron ore into direct-reduced iron (DRI) using hydrogen, which reacts with the ore's oxygen and forms steam as a byproduct. Hot DRI and steel scrap is then melted in an electric arc furnace, sending waste heat to the district heating channels of Luleå-Boden, and processing slag into products to be used in other industries. The liquid steel is solidified into solid products through an integrated continuous casting and rolling process. This method reduces energy consumption by 70% and eliminates the use of natural gas typically found in traditional processes.

The project is expected to be operational by December 2026 and should avoid emissions of over 33.4 MtCO_2-eq over a 10-year operational period. It will create 2 000 direct jobs, contribute to the creation of 10 000 further indirect jobs and help to achieve the EU's ambition (as set out in the EU industrial strategy) of decarbonising heavy industry.

99 https://ec.europa.eu/assets/cinea/project_fiches/innovation_fund/101133206.pdf

2. IRIS: Innovative low carbon hydrogen and methanol production by large scale carbon capture[100]

The IF has granted EUR 126.79 million to a first-of-a-kind carbon capture storage and utilisation (CCUS) project in Corinthia in Greece. IRIS will decarbonise the Agioi Theodoroi Refinery by applying carbon capture technology to its steam methane reformer (SMR). The post-combustion capture technology that has been selected for IRIS will allow both unperturbed ultra-low-carbon hydrogen production and continuous high-pressure steam generation.

The bulk of the captured carbon will be sequestered in an offshore storage facility in the northern Aegean, but a small amount will be used to produce 10 000 tonnes of e-methanol per year for use as an energy carrier in both mobility and industrial applications. Besides its use within the refinery, the hydrogen that is produced will be used as fuel in transport applications. E-methanol will be used for maritime applications as a low-carbon substitute for marine fuels. The project will also promote the scalability of the CCUS chain to two other refinery units, potentially decreasing the total refinery carbon footprint by a further 25%.

Entry into operation is planned for mid-2028. The project should avoid 8.58 $MtCO_2eq$ over a 10-year operational period, creating up to 2 000 jobs during construction and 21 permanent jobs during the project's operating lifetime. At the EU level, it will particularly help to achieve both the Net-Zero Industry Act target of 50 million tonnes a year of CO_2 storage capacity by 2030 and the REPowerEU target of reducing fossil fuel consumption in industry and transport.

3. SHEEFT: Solar Heliup Energy for flat rooftops[101]

The IF has granted EUR 3.2 million to a solar photovoltaic (PV) panel project in Le Cheylas in France. Thanks to the IF's support, SHEEFT will deploy industrial-sized manufacturing of ultra lightweight solar PV panels designed for existing large building rooftops with low bearing capacities.

SHEEFT's innovative nature lies in its installation concept, which involves directly bonding the panel to a waterproofing membrane, thus reducing weight by 60% compared with conventional solutions. This technology, which is well adapted to flat rooftops and is weather resistant, is based on a patented design that uses ultra-thin glass.

In line with the REPowerEU plan, the project's production capacity is set at 100 megawatt peaks (MWp) per year and aims to avoid 363 660 tonnes of CO_2 equivalent over a 10-year period. The project will create 100 direct jobs and 150 indirect jobs. It is scheduled to begin operating in late 2024.

4. T-HYNET: Tarragona Network Hydrogen[102]

The IF is backing the development of a cutting-edge 150-megawatt (MW) capacity alkaline electrolyser project in Spain's Tarragona industrial area. Thanks to the IF's EUR 62 million grant, T-HYNET will become Spain's largest electrolyser initiative, continuously producing 2.7 tonnes of renewable hydrogen per hour.

The electrolyser's state-of-the-art design features advanced alkaline technology, increased use of digital tools, and increased water-use efficiency by minimising water discharge and maximising water recovery. The renewable hydrogen that will be produced will be transported by a hydrogen pipeline to industrial off-takers and injected into the nearby natural gas network. The project's strategic location in Catalonia's Hydrogen Valley and the Ebro Hydrogen Corridor will facilitate hydrogen transmission to off-takers across the EU.T-HYNET is expected to create 900 direct and 1 100 indirect jobs, and to avoid emitting 1.4 million tonnes of CO2 over a 10-year operational period. Aligning with the European hydrogen strategy and RePowerEU initiatives, construction is set to be completed by the end of 2026.

100 https://ec.europa.eu/assets/cinea/project_fiches/innovation_fund/101133015.pdf
101 https://ec.europa.eu/assets/cinea/project_fiches/innovation_fund/101156515.pdf
102 https://ec.europa.eu/assets/cinea/project_fiches/innovation_fund/101133010.pdf

12.2 Example of project funded by the Modernisation Fund

The **Modernisation Fund**[103] supports the modernisation of the energy systems and the improvement of energy efficiency in 13 lower-income EU Member States (Bulgaria, Croatia, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Portugal, Romania, Slovenia and Slovakia). Established in 2018 for the 2021-2030 period, the fund aims to help the beneficiary Member States achieve their climate and energy targets and the objectives of the European Green Deal.

Financed by the EU Emissions Trading System (EU ETS), the fund primarily focuses on six priority areas: renewable energy generation and use, renewable heating and cooling, energy efficiency across sectors, energy storage and network modernisation, low-income household support, and just transition in carbon-dependent regions. A maximum of 20% can be allocated toward non-priority investments that reduce greenhouse gas emissions but do not fall in the priority areas.

The Modernisation Fund operates under the responsibility of the beneficiary Member States, who work in close cooperation with the European Investment Bank (EIB) and the Commission. Together, the Commission, the EIB and 16 EU Member States compose the Investment Committee for the Modernisation Fund (Investment Committee) that approves the investments, while the EIB examines Member State proposals.

1. Support the production of electricity from renewable energy sources in Croatia

The Modernisation Fund has agreed to disburse EUR 80 million in support of a renewable energy sources (RES) production scheme in Croatia.

The investment aims to bolster the construction and installation of RES production facilities of photovoltaic (PV) panels, biomass and biogas. Furthermore, this scheme will benefit projects and enterprises in manufacturing industries and in activities related to steam and air conditioning supply, including ETS installations.

The overall objective of this scheme is to address market failures related to negative externalities in the energy sector and limited grid transmission capabilities. The desired outcome is to reduce energy procurement costs for beneficiaries and to encourage investment in RES installations at production plants and associated facilities throughout Croatia.

The scheme foresees installing an energy capacity of 80 megawatts (MW) and energy storage capacity of 20 MW and should generate energy consumption savings of 140 000 Megawatt hours (MWh) and avoid around 60 000 tonnes of CO_2 emissions during a typical operational year. On a national scale, the scheme contributes to the goals set in the National Energy and Climate Plan. The construction of facilities for dispersed energy production at points of consumption will also have long-term positive impacts on the national electricity grid, such as reduction of the peak load or reduction of losses in the grid.

On a European scale, this scheme contributes to achieving the goals set forth by the European Green Deal and in the RePowerEU plan, by reducing greenhouse gas emissions and increasing the share of renewable energy. EUR 40 million have already been disbursed to Croatia for projects under this scheme.

2. Contract for Difference Support Scheme for the production of electricity from renewable sources onshore wind and solar photovoltaic energy in Romania.

In 2024, the Modernisation Fund made a first tranche of EUR 5 million to Romania to implement a contract for difference support scheme. This scheme seeks to develop 5 gigawatts (GW) of onshore wind and solar photovoltaic (PV) capacities through two auctions between 2023 and 2025, aiming to support 50-250 beneficiaries of all sizes.

Led by the Romanian Ministry of Energy, this scheme works as a variable premium payment for each megawatt hour (MWh) of electricity generated and delivered to the grid. The payment is calculated based on the difference between a competitively fixed price (strike price) and the market price (reference price). The total support from the Modernisation Fund for the scheme will be determined following the two auction rounds, based on the actual strike prices.

The objectives for this scheme are well-aligned with the RePowerEU plan and the Green Deal Industrial plan as the scheme is contributing to increasing the share of renewable energy sources in the energy mix and reducing greenhouse gas emissions. The scheme also supports the national decarbonisation objectives of the 2021-2030 national energy and climate plan, with a focus on 2023-2025, while maintaining energy security and generation diversification. It will also aid the local economy with increasing jobs and skill diversification.

103 https://climate.ec.europa.eu/eu-action/eu-funding-climate-action/modernisation-fund_en

12.3 Land and Nature

LIFE PeatCarbon

LIFE PeatCarbon will help restore peatlands ecosystems in Latvia and Finland by demonstrating approaches to the climate-smart management of degraded peatlands and testing innovative methods for GHG monitoring. The project is expected to restore 5 076 and 338 hectares of peatland in Latvia and Finland respectively. This will save 37 117 tCO_2eq per year in Latvia and 3 500 tCO_2eq per year in Finland.

SWIFTT project: Climate change risks in Forestry

The SWIFTT project, financed by Horizon Europe, will provide a scientifically sound and technically feasible way to help monitor and manage forest risks: windthrow, insect outbreaks, and forest fires. SWIFTT will enable forest managers to adapt to climate change with affordable, simple and effective remote sensing tools backed up by powerful machine learning models. The solution will offer a monthly health monitoring service including early warnings, using Copernicus satellite imagery to detect and map the various risks to which forests and their managers are exposed. Early threat detection aids timely intervention. SWIFTT will be tested in real conditions by several end-users from the forest industry, which include Fürstliches Forstamt, Groupe Coopération Forestière and the Rigas Mezia. Once completed, SWIFTT's maps detailing areas of windthrow damage, insect outbreaks, and fire risk will enable forest managers to act proactively and allocate resources efficiently for a timely intervention. With SWIFTT's sustainable, effective, and low-cost forest management tools, Europe will be better positioned to combat climate change and preserve its biodiversity through healthier forests. The solution will help to monitor and protect up to 40 ml of ha of global forests by 2030, saving foresters over EUR 468 ml in monitoring costs.

12.4 Sustainable mobility

Connecting Europe Facility (CEF)

In July 2024, the Commission announced grants of over EUR 7 billion to improve sustainable, safe and smart transport infrastructure throughout the EU. This funding, which is the largest under the current Connecting Europe Facility (CEF) transport programme, will support 134 projects aimed at expanding and modernising the Trans-European Transport Network (TEN-T). 80% of the total investment will go to rail projects, to strengthen cross-border connections along the EU's TEN-T core network. These include Rail Baltica, the Lyon-Turin connection between France and Italy and the Fehmarnbelt undersea tunnel linking Denmark and Germany.

Around 20 maritime ports in Germany, Ireland, Greece, Spain, Croatia, Cyprus, Lithuania, Malta, the Netherlands, Poland and Finland will receive support for infrastructure upgrades. Some will introduce sustainable practices such as the supply of shore-side electricity to ships and renewable energy transport.

12.5 Preparedness and resilience

Mission Regions4Climate

The Burgas region in **Bulgaria** faces a series of climate-related challenges (including flooding and urban heat and air pollution) due to rising temperatures and the characteristics of its terrain and wetlands. These are compounded by urban density and limited green space.

To combat these climate challenges, the region adhered to the Mission Adaptation Charter and is part of the Mission Regions4Climate project. Thanks to the supported Smart Adaptation Challenge Suite (an innovative digital tool that gathers the latest data from diverse sources), the Burgas region can bridge the science-stakeholder-policy gap, raise citizens' awareness, and improve the use of existing data.

The Burgas region has introduced innovative community-involving planning solutions and enhanced flood risk prediction. It implements multifunctional nature-based solutions which also mitigate the effects of urban heat islands, address air pollution and increase urban resilience. The region is using digital simulations for knowledge-sharing and a tailormade climate resilience model to improve decision-making. A local climate resilience group that involves a wide range of stakeholders has been established to monitor, steer and consult on the implementation of pilot actions, as well as to suggest corrective measures where needed.

LIFE UrbanStorm

LIFE UrbanStorm developed climate-resilient urban storm water management systems in Estonia to better manage flash floods in urban environments. Over the project lifespan, which ended in 2023, annual rainwater emergencies in the city of Viimsi fell from 21 to 13; and from 7 to 0 in the demonstration area in the capital Tallinn. The number of floods in Viimsi was more than halved.

100KTREEs: Climate change adaptation in cities

The ambition of the HORIZON Europe project 100KTREES is to make cities a better and healthier place to live by encouraging municipalities to plant more trees and to optimize the impact of tree planting by leveraging Copernicus data. The benefits of urban trees planting include: improvements in air quality, increasing carbon sequestration, reduction of urban heat islands, improvement in urban biodiversity, reduce risk of pluvial flooding, reduce noise levels. In particular, the project is developing a toolbox were valorisation of tree impacts, cost benefit analysis, and what-if scenarios (long and short term) are considered, providing valuable business cases for the end-users for planting trees in cities and effectively implement climate adaptation strategies. During the development of the 100KTREEs toolbox, two end-users represented in the consortium, the city of Copenhagen and the city of Sofia, will be proactively engaged for continued feedback on its usability and utility. Co-creation workshops will be organized to collect the requirements of the involved municipalities. At the end of the project the toolbox will be offered to city clients as SaaS (Software as a Service).

Destination Earth's Digital Twins enhancing climate resilience

This pioneering information system, once ready, will enable the testing of adaptation options and policies, considering the evolution of the Earth system in a warming world. At its core are several innovative components including two digital twins, and an AI-enabled digital ecosystem which intends to connect users to a portfolio of novel applications and services.

The Weather-Induced Extremes Digital Twin offers global information at kilometer-scale resolution for several days ahead, also creating a capability to 'zoom in' on severe events across Europe. It intends to support authorities to safeguard lives and properties, and prepare for extreme events in a warming world.

To help adapting to the future climate, the Climate Digital Twin will enable the use of next-generation kilometer-scale climate models, delivering data and impact-relevant climate indicators both regularly and on-demand. This advancement will support climate-related actions, such as risk assessments, and at a later stage the assessment of adaptation options.

12.6 Society and Communities

LIFE Climate Smart Chefs

The LIFE Climate Smart Chefs project has created the digital Foodprint tool to design climate-smart menus that empower the EU's chefs to become active challengers of climate change and promoters of low emission, nutritious and affordable diets. About 500 chefs in the EU have used Foodprint to reformulate recipes, so that they now use 34% less water than before and have reduced process CO_2 emissions by 49%.

LIFE Cool Square

The LIFE Cool Square project will undertake a significant greening of the Damsterplein of Groningen in the Netherlands. Turning it into a climate-adaptive, resilient and multifunctional urban location will mitigate heat island effects and reduce the negative health impacts associated with traffic. By the time the project concludes in 2026, it is expected to increase the use of Damsterplein by Groningen residents by 50% and to reduce traffic speed by 15% – leading to lower air pollutant levels (NOx and PM) and reduced noise emissions.

12.7 International Initiatives

In June 2023, the Commission and the High Representative adopted a joint communication laying out how the EU will address the growing impact of climate change and environmental degradation on peace, security and defence.

The four main priorities of the Communication are to:

- **Strengthening planning, decision-making and implementation**, through reliable and accessible evidence-based analysis and data on the climate and security nexus;
- **Operationalising the response to environment, climate and security challenges in EU external action and instruments;**
- **Enhancing** climate adaptation and mitigation measures of EU Member States' c**ivilian and military operations and infrastructure** to lower costs, carbon footprints, while maintaining operational effectiveness;
- **Reinforcing international partnerships** through multilateral, plurilateral and bilateral fora and with partners such as UN, OSCE, NATO, African Union.

Copernicus' Emergency Management Service plays an important role in supporting early-warning capacities, as well as the Copernicus Land Monitoring Service providing geospatial information on land cover and its change, water cycle and Earth's surface energy variables.

Example of use of geospatial observation data and analysis:

Commission and EEAS services are producing an annual comprehensive climate and security trend analysis. Use of data, analysis and indicators on climate and environment-related risks is promoted, including by the establishment of a climate and security hub located at the EU's Satellite Centre.

The Commission and ESA are working together under the Joint RTD-EOP Earth System Science initiative to jointly advance Earth system science and its contribution in responding to the global challenges faced by society, including accelerating the use of Earth-observing satellites and the information which they provide to address climate change.

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