ETC CM Report 2024/06

Approximated EU greenhouse gas inventory

Proxy GHG emission estimates for 2023

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Executive summary

This report provides GHG emissions estimates for the EU including LULUCF and indirect CO_2 emissions. This executive summary includes an analysis of the important changes in GHG emissions across the EU, by sector and by Member State.

For EU27 the 2023 emissions are estimated to be 2862 million tonnes of CO_2 equivalents (Mt CO_2 eq.), which indicates a decrease from 2022 of 276 million tonnes of CO_2 equivalents, or 8.8 % (total GHG emissions including LULUCF and indirect CO_2).

International aviation equalled to EU27 to 120 million tonnes of CO_2 equivalents in 2023, which is 9.8 % higher than in 2022. Table ES-1 provides details on the total levels of emissions.

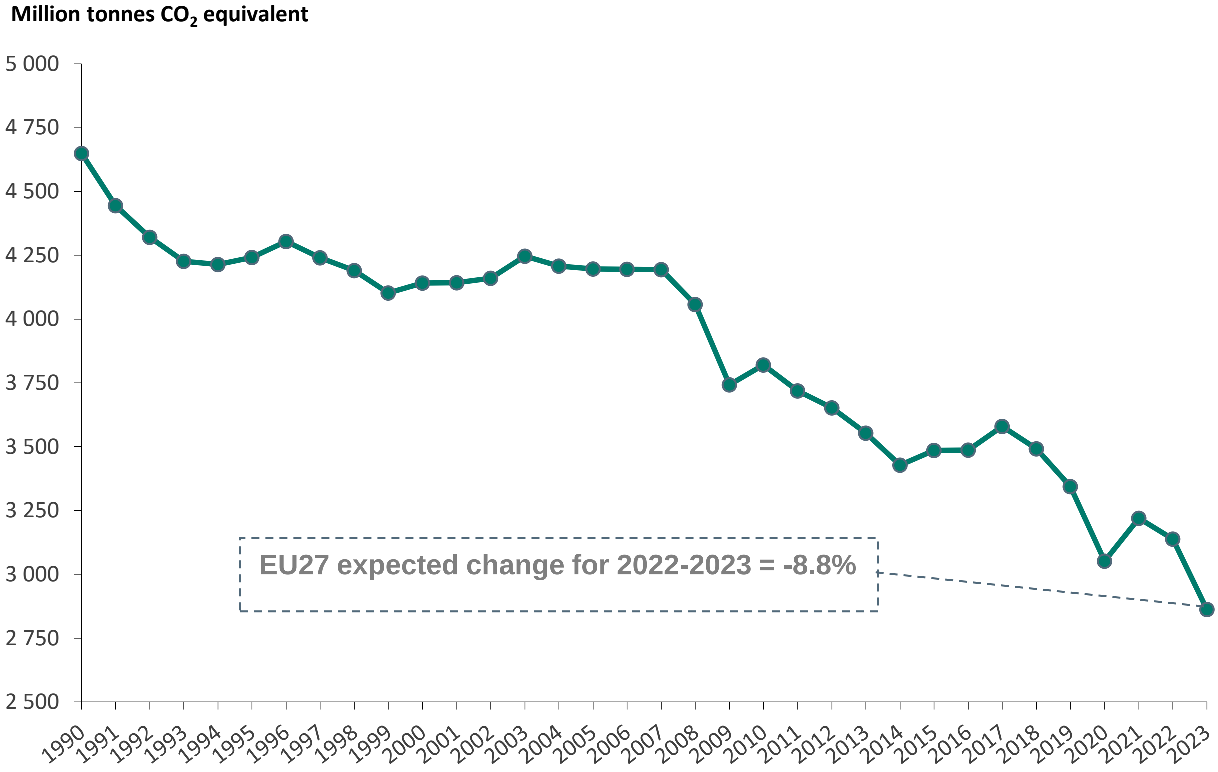
Emissions in 2023 follow the decreasing trend visible between years 2017 and 2022 which was only disrupted in 2020 by an exceptionally strong decrease caused by the COVID-19 pandemic situation (Figure ES-1).

The changes in 2023 are caused by a number of reasons, whereby is important to mention decrease in total energy consumption. Changes in the fuels consumed in 2023 are mostly driven by the energy crisis triggered by Russia's invasion of Ukraine and therefore don't follow the weather conditions as much as in previous years.

Table ES-1 Emissions including international aviation (kt CO_2 eq.)

European Union (EU27)	1990	2022	2023	2023-2022	2023/2022	2023-1990	2023/1990
Total excl. LULUCF incl. indirect CO_2	**4 867 243**	**3 374 743**	**3 118 576**	**-256 167**	**-7.59%**	**-1 748 667**	**-35.93%**
LULUCF	-217 472	-236 402	-256 557	-20 155	8.53%	-39 085	17.97%
Total incl. LULUCF incl. indirect CO_2	**4 649 770**	**3 138 341**	**2 862 019**	**-276 323**	**-8.80%**	**-1 787 752**	**-38.45%**
International aviation	54 632	109 723	120 484	10 761	9.81%	65 852	120.54%
Total incl. LULUCF and international aviation	**4 704 402**	**3 248 064**	**2 982 503**	**-265 562**	**-8.18%**	**-1 721 900**	**-36.60%**

Figure ES-1 Trends in total GHG emissions, 1990-2023



Note: Total GHG emissions with LULUCF including indirect CO_2.

Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

Changes in EU GHG emissions by sector

On a sectoral basis, the largest absolute emission change occurred in the Energy sector (i.e. all combustion activities and fugitive emissions from energy). Energy related emissions decreased by 228 Mt CO_2 eq. (8.8%) across the EU. The largest change in fuel combustion emissions occurred in 1.A.1 Energy industries with a decrease of 172 Mt CO_2 eq. The emissions reported in this category comprise from fuels combusted by the fuel extraction or energy-producing industries. The decrease in this category was affected by the energy crises triggered by Russia's invasion of Ukraine.

These changes in emissions in 2023 reflect changes in the fuel mix. Primary fossil energy consumption decreased in 2023. The contribution of coal, gas and oil to the energy mix decreased in 2023 while primary energy consumption of renewables increased in 2023. Primary energy consumption of nuclear energy increased slightly as well as its contribution to the energy mix.[1]

Different trends in consumption for the different fossil fuel types can be seen in 2023. The consumption of solid fossil fuels decreased significantly by 19.7 % while consumption of liquid fuels decreased by 1.7 % and gaseous fossil fuels consumption decreased by 7.3 %. (EEA 2024 a)

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[1] The final version of the report will include information regarding renewable energy use which was not yet available at the time the report was being prepared.

Emissions from Industrial Processes decreased by 18 Mt CO_2 eq. (-6.1 %) in the EU27. The largest contribution to this emission decrease was from 2.A Mineral products, which decreased by 6.9 Mt CO_2 eq. Emissions from Agriculture decreased by 7.4 Mt CO_2 eq. (-2.0 %). The decrease in agriculture sector emissions is largely driven by decreased emissions from enteric fermentation. The trend in emissions from waste (−1.4 Mt CO_2 eq. compared to previous year) continues the decrease seen in previous years with largest reduction being in emissions from solid waste disposal.

LULUCF removals increased between 2022 and 2023 (-20.2 Mt CO_2 eq. or 8.5 %). The trends of 4.A Forest land significantly dominate the sector.

ETS emissions (mostly covering emissions from electricity and heat production) have decreased more than the Effort Sharing Regulation emissions. Between 2022 and 2023 the emissions decreased by 16.7 % across stationary installations covered by the European Emissions Trading System for the EU and emissions covered by the Effort Sharing Regulation decreased by 2.0 %.

Changes in member state's GHG emissions

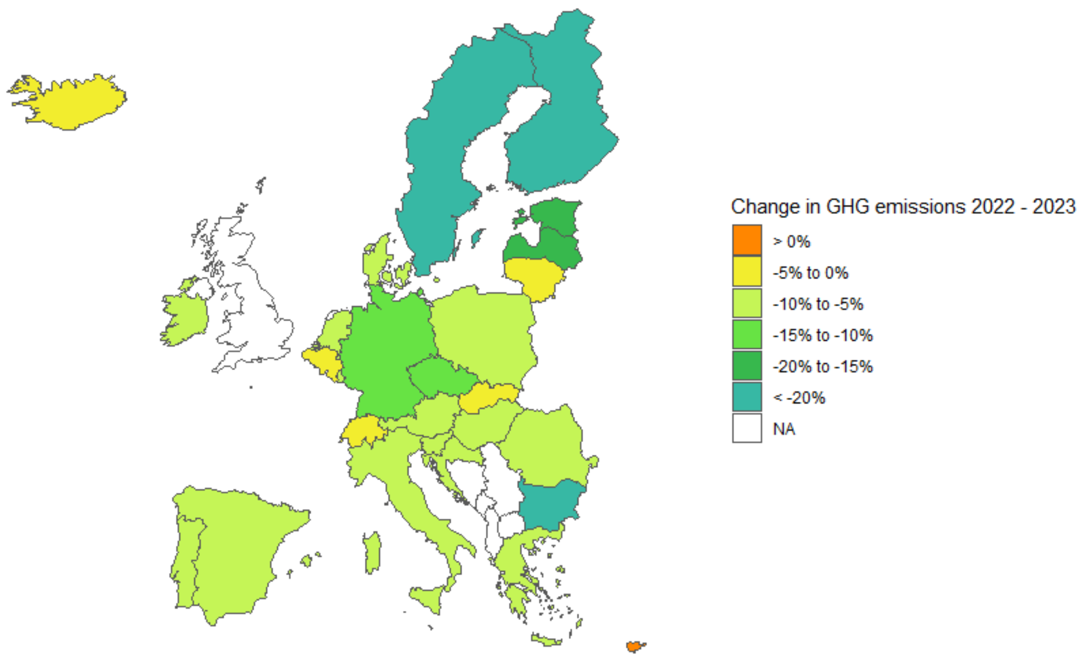
Greenhouse gas emissions decreased in twenty-six EU Member States in 2023. Figure ES-2 depicts the regional distribution of these changes which differ significantly between different regions.

Comparing the changes across Member States, the largest absolute emission change occurred in Germany, where emissions decreased by 77 Mt CO_2 eq. Apparent decrease in emissions occurred also for Italy (-29 Mt CO_2 eq.) and the Poland (-28 Mt CO_2 eq.). The only very little emission increase occurred in Cyprus (+0.03 Mt CO_2 eq.).

The largest relative declines in emissions compared to the previous year took place in Bulgaria (-27.4 %) and Sweden (-25.6 %). The only relative increase was in Cyprus (+0.3 %).

In the non-EU member countries of the EEA, emissions decreased in Switzerland (-2.2 %, or -0.9 Mt CO_2 eq.), Iceland (-1.8 % or -0.2 Mt CO_2 eq.) and Norway (-6.5 % or -2.3 Mt CO_2 eq.).

Figure ES-2 Regional trends in total GHG emissions change 2022-2023



Note: Total GHG emissions with LULUCF including indirect CO_2. Emissions for Croatia relate to the corrected version submitted in April 2024.

1 Introduction

This approximated GHG inventory is an early estimate of the GHG emissions for the preceding year. The legal basis for the approximated GHG emission estimates is Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action. Article 26(2) requires Member States to submit to the Commission approximated greenhouse gas inventories for the year *t*-1 by 31 July every year. The European Environment Agency (EEA) assists the Commission in the compilation of the Union approximated greenhouse gas inventory. These estimates are referred to as approximated ('proxy') estimates or inventories as they cover the year for which no official GHG inventories have been prepared. Should a Member State not provide their own proxy emission estimate, the EEA produces and uses gap-filled estimates in order to have a complete approximated GHG inventory for the European Union. Non-EU member countries of the EEA are invited to submit their proxy estimates on a voluntary basis.

The scope of the proxy estimates covers total GHG emissions, for all gases, sectors, and Member States, as reported under the UNFCCC including the land use, land-use change and forestry (LULUCF) sector, indirect CO_2 and international aviation.

Member States are responsible for the methodological choice regarding their own estimates. For gap-filling where a Member State has not provided their own estimate the EEA has used the latest Eurostat and EU ETS data to carry forward reported emissions from the energy and industrial processes sectors. These two source categories typically account for the bulk of emissions and have the largest annual change. International aviation was gap-filled, in case reporting countries have not reported the data. The gap-filling procedure used flight and emission data provided by Eurocontrol.

The EU aims to have a leading role in the emission reduction and for this purpose a number of measures have been adopted. One of the most important measures is the Effort Sharing Regulation, which covers sectors of the economy which fall outside the scope of the EU Emission Trading Scheme. These sectors, which include transport, buildings, agriculture, non-ETS industry and waste, account up to 62 % of the total EU emissions (EEA 2023).

The official submission of 2023 inventories to the United Nations Framework Convention on Climate Change (UNFCCC) will take place in 2025.

Table 1-1 provides an overview of different emission estimates by EU bodies. More information can be found on the EEA website 'Note on different emission estimates by EU institutions': www.eea.europa.eu/publications/different-emission-estimates-by-eu-bodies-2

Table 1-1 **Overview of EU data sources for GHG estimates**

What	Who	When	Time	Geographical scope	Sectoral Scope	Obligation
GHG inventory to UNFCCC	EEA and DG CLIMA	15 April	*t*-2	EU and its 27 Member States	All gases and sectors (100% of emissions)	EU Regulation (2018/1999)
Approximated / Proxy GHG inventory	EEA, DG Climate Action	31 October	*t*-1	EU and its 27 Member States and other EEA member countries when available	All gases and sectors (100% of emissions)	EU Regulation (2018/1999)
EU ETS	DG Climate Action, EEA	Early April, May and summer (between July and September)	*t*-1	EU27 and other EEA member countries	About 9,500 installations (~39% of total emissions)	EU ETS Directive (2003/87/EC)
CO_2 early estimates from fossil fuel combustion	Eurostat	April / May	*t*-1	EU and its 27 Member States	CO_2 from fossil fuel combustion (~80% of total emissions)	Eurostat's work programme
Air emissions accounts, air emission intensities and air emission footprints	Eurostat	annual	t-2	EU27	Six greenhouse gases including CO_2 and seven air pollutants	Regulation (EU) 691/2011 (Annex I)

2 European GHG emissions in 2023

A total of twenty-five Member States submitted preliminary 2023 GHG data to the European Commission and the EEA by 31 July 2023. Austria, Belgium, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Hungary, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden all submitted emissions data in the form of largely[2] complete CRF Summary2 tables. The methodologies used for any gap-filling are described in chapter 4.4.1.

These 25 countries that submitted 2023 proxy estimates represent more than 96% of EU27 total emissions.

The EEA used gap-filled estimates for Bulgaria in order to have a complete approximated GHG inventory for the European Union (section 4.3).

Additionally, three EEA member countries submitted preliminary 2023 GHG data by 31 July 2024: Iceland, Switzerland and Norway.[3]

Approximated GHG inventories in CRF Summary2 table format are presented for the EU27 in chapter 2.1.5. Annex 1: Detailed results for each Member State provides a link to the Reportnet3 where the CRF Summary 2 table information is available for each of the 27 EU Member States and also for Iceland, Switzerland and Norway in PDF.

2.1 Trend and overall results

2.1.1 Changes in GHG emissions across the EU

For EU27 the 2023 GHG emissions including LULUCF and indirect CO_2 emissions are estimated to be 2862 million tonnes of CO_2 equivalents (Mt CO_2 eq.), which indicates a decrease from 2022 of 276 million tonnes of CO_2 equivalents (Mt CO_2 eq.).

The estimates for 2023 indicate the continuity in trend which was observed between 2017 and 2019. Emissions levelled off between 2014 and 2017 (Figure 2-1), then decreased between 2017 and 2020. The exceptionally strong decrease in 2020 was caused by the COVID-19 pandemic situation. The estimate for 2023 shows 8.8 % decrease compared to 2022 emissions level. The decrease is mostly driven by the energy crisis triggered by Russia's invasion of Ukraine.

International aviation equalled to EU27 to 120 million tonnes of CO_2 equivalents in 2023, which shows an increase of 9.8 % in comparison to the 2022 levels.

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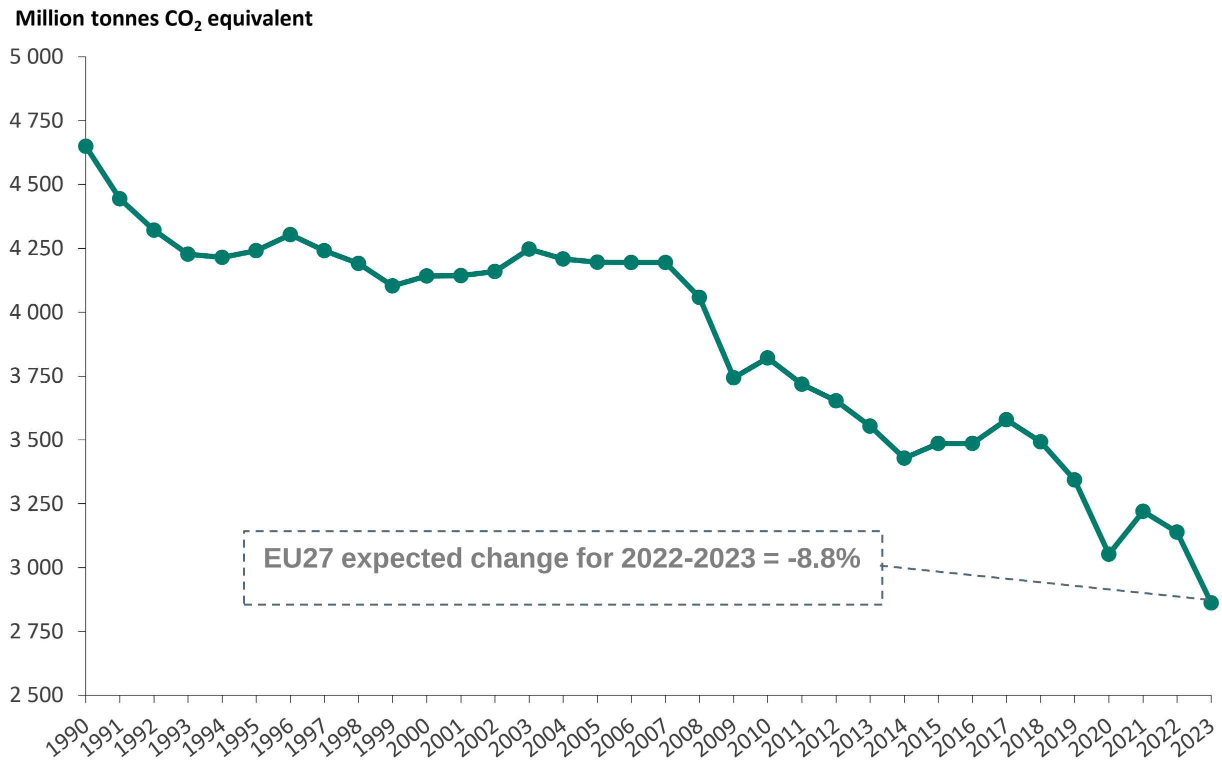
2 Where sub-sector emissions detail was not available it was gap-filled using simple allocation based on the previous year's splits. In some instances, sub-sectors emissions needed to be summed for sectors. These minor modifications were performed for Denmark, Germany, Greece, Ireland, Luxembourg and Sweden.

3 Other non-EU Member States of the EEA are Liechtenstein and Turkey. As these countries did not submit any GHG data for2023, they are not considered in this report.

Figure 2-1 Trends in total GHG emissions, 1990-2023

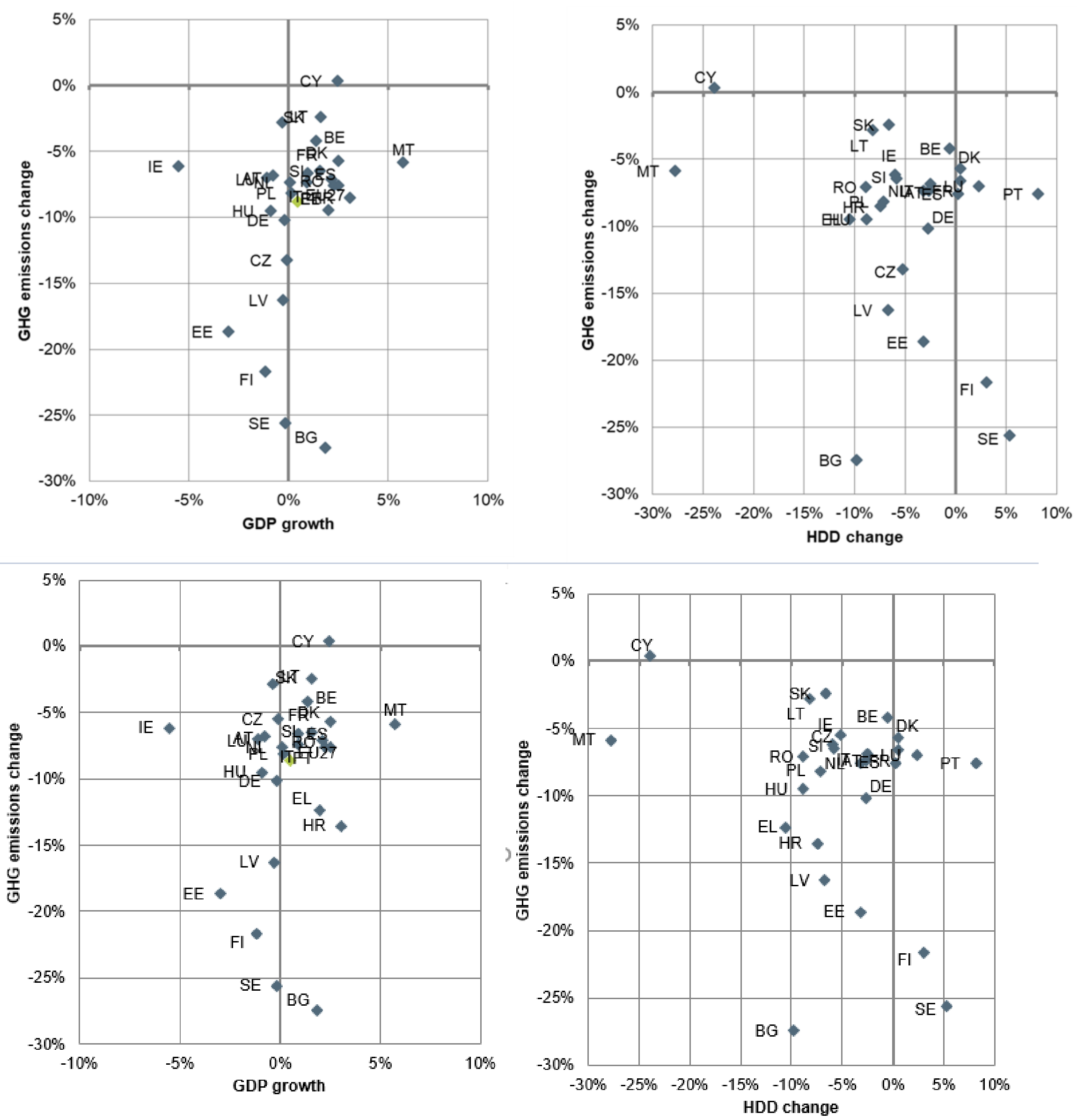


Note: Total GHG emissions with LULUCF including indirect CO_2

Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

The trend shows 8.8 % decrease in emissions for the EU27 since 2022, although the GDP growth is showing a positive trend of 3.4 % in the same year (Figure 2-2). Twenty-six Member States achieved decreases in emissions while sixteen Member States had negative GDP growth.

Figure 2-2 GHG emissions, GDP growth and heating degree days change 2022-2023



Note: Heating Degree Days (HDDs) are an indication of heat demand based on outdoor temperatures. Positive HDD change can correlate with increased heating demand.

Source: EEA's ETC CM, based on GDP from EEA (Gross domestic product at market prices, Chain linked volumes (2015), mrd euro) and Eurostat Heating Degree Days (HDDs), an indication of heat demand based on outdoor temperatures, from Eurostat. HDD change was not available for EU27.

Climatic factors have a significant effect on energy demand and GHG emission trends. The globally exceptionally warm years were from 2015 to 2023. In Europe, 2023 was the second-warmest year, at 1.02°C above the 1991-2020 average, 0.17°C cooler than the warmest year on record 2020 (Copernicus 2024). Winter in 2023 was the second-warmest winter on record, nevertheless the difference with reference period temperatures wasn't exceptional. The pattern in heating degree days (a standardized measure for linking heating demand and weather conditions) confirms lower heating demand in 2023 compared to 2022. The highest increase in cooling degree days in 2023 was observed for Portugal. Figure 2-2 also shows that in Denmark, Spain, Finland, France and Sweden heating degree days increased while total emissions decreased and in Cyprus heating degree days decreased while GHG emissions increased.

2.1.2 Changes in EU GHG emissions by sector

On a sectoral basis, the largest absolute emission change in the EU occurred in the energy sector (i.e. all combustion activities and fugitive emissions). Energy related emissions decreased by 228 Mt CO_2 eq. (−8.8 %) across the EU. Within the energy sector, emissions decreased mainly in 1.A.1. Energy industries (-172 Mt CO_2 eq.), particularly in heat and electricity production, also in 1.A.4 Other sectors (-27 Mt CO_2 eq.) and 1.A.2 Manufacturing industries and construction (-21 Mt CO_2 eq.). The other subsectors decreased as well such as 1.A.3 Transport (-6.1 Mt CO_2 eq.) and 1.B Fugitive emissions from fuels (−2.1 Mt CO_2 eq.).

These changes in emissions in 2023 reflect changes in the fuel mix. Primary fossil energy consumption decreased in 2023. The contribution of coal and gas to the energy mix decreased while the share of oil increased slightly. This is because the energy crisis restricted gas supply and higher prices triggered an overall reduction in industrial demand. Primary energy consumption of nuclear energy increased slightly as well as its contribution to the energy mix.

Consumption of wind, photovoltaics, hydro and solid biofuels are from the ETC renewable energy proxy 2023. (EEA 2024 b) Hydro values are pure hydro without pumping. Wind and hydro values are not normalised.

In the EU27, primary energy consumption of renewable energy increased by 4.9 % in 2023 while gross final consumption of energy from renewable sources by 2.7 %. Consumption of wind changed (+14.2 %), hydro (+18.9 %), photovoltaics (+18.9 %) while consumption of solid biofuels decreased (-13.9 %). Renewable energy share increased to 24.1 % with RES E (+44.4 %), RES T (+10.1 %) and RES H&C (+25.4 %) in the EU27.

Consumption of coal, oil, gas and nuclear energy are primary energy consumption[4] values from the ETC energy efficiency proxy 2023. (EEA 2024 a) Different trends in consumption for the different fossil fuel types can be seen in 2023. The consumption of solid fossil fuels decreased significantly by 19.7 % and gaseous fuels consumption decreased by 7.3 % while consumption of liquid fuels decreased by 1.7 %.

The gaseous fuels consumption increased in four Member States with largest increases in Finland (+6.2 %), Malta (+5.6 %) and Poland (+5.3 %). In twenty-two Member States liquid fossil fuels consumption decreased with the largest decreases in Portugal (-19.8 %) and Greece (-13.1 %) and France (-11.7 %)

Liquid fossil fuels consumption increased in 9 Member States with the largest increases being in Lithuania (+4.4 %), Netherlands (+2.5 %) and Croatia (+1.7 %). In eighteen Member States liquid fossil fuels consumption decreased with the largest decrease in Slovenia (-11.3 %), Finland (-6.1 %) and Germany (-5.4 %).

Solid fossil fuel consumption increased only in Austria (+1.0 %). Twenty-five Member States showed decreasing solid fossil fuel consumption. The largest decreases were in Latvia (-45.4 %), Bulgaria (-38.7 %) and Lithuania (-35.7 %).

These changes in fossil fuel consumption are not only related to heating degree day (HDD) effects as described in section 2.1.1 but also strongly connected to the trends in electricity generation from fossil fuels and the war in Ukraine which affected gas prices.

In 2023 nuclear energy production across the EU increased by 1.6 % compared to 2022. Nuclear electricity generation increased in five Member States. The highest increases were in Finland (+35.0 %), Slovakia (+14.7 %) and France (+14.3 %). Nuclear electricity generation decreased in eight Member States. The largest decreases in nuclear electricity generation occurred in Germany (−79.2 %) followed by Belgium (-25.0 %) and Sweden (-7.0 %).

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4 Primary energy consumption is calculated as final consumption non energy use subtracted from gross inland consumption.

The emissions from the sector Industrial Processes and Product Use decreased by 18 Mt CO_2 eq. (6.1 %) between 2022 and 2023 in the EU27. The largest contribution to this emission decrease was from mineral industry, which decreased by 6.9 %, followed by emission decreases in metal industry and also by category 2.F Product uses as substitutes for ODS.

Agriculture emissions decreased by 7.4 Mt CO_2 eq. (-2.0 %) mainly due emission decreases from enteric fermentation, agriculture soils and manure management.

The trend in emissions from waste (-1.4 Mt CO_2 eq. or −1.3 % compared to previous year) continues the decrease seen in previous years with largest reduction being in emissions from solid waste disposal.

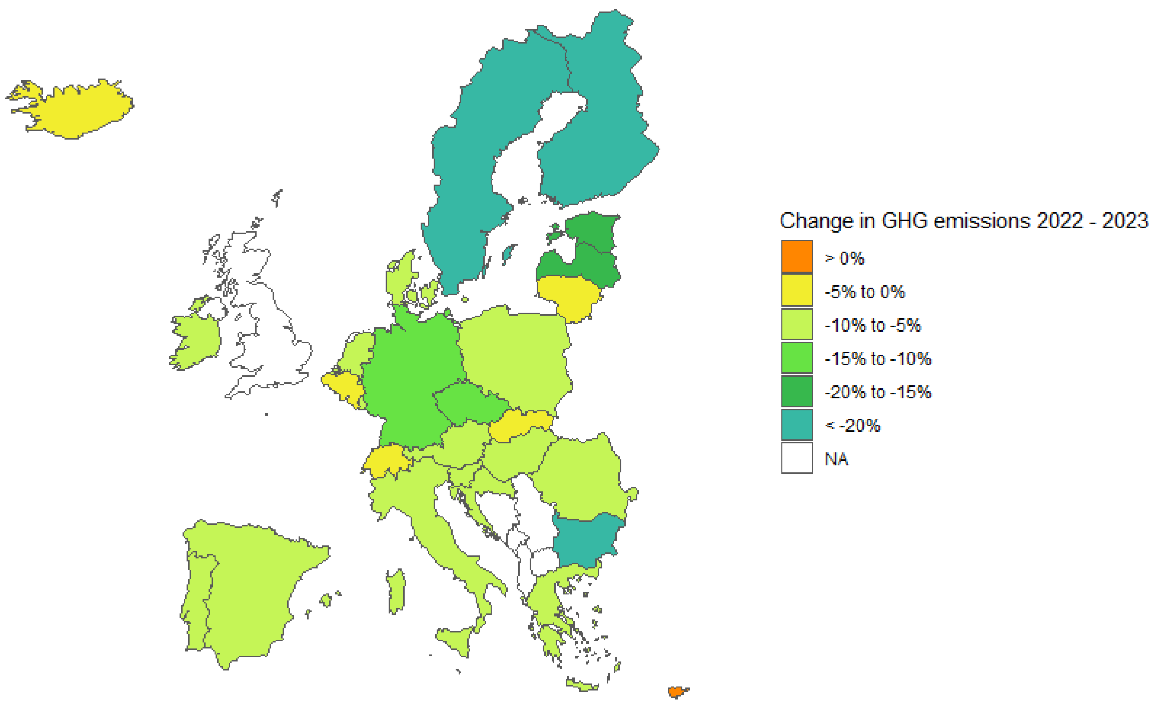
LULUCF removals increased between 2022 and 2023 (-20.2 Mt CO_2 eq. or 8.5 %). The trends of 4.A Forest land significantly dominate the sector.

Between 2022 and 2023 the emissions decreased by 16.7 % across stationary installations covered by the European Emissions Trading System for the EU and emissions covered by the Effort Sharing legislation decreased by 2.0 %.

2.1.3 Changes in member states GHG emissions 2022 to 2023

Total greenhouse gas emissions including LULUCF and indirect CO_2 emissions decreased in twenty-six EU Member States in 2023. Figure 2-3 depicts the regional distribution of these changes which differ significantly between different regions.

Figure 2-3 Regional trends in total GHG emissions change 2022-2023



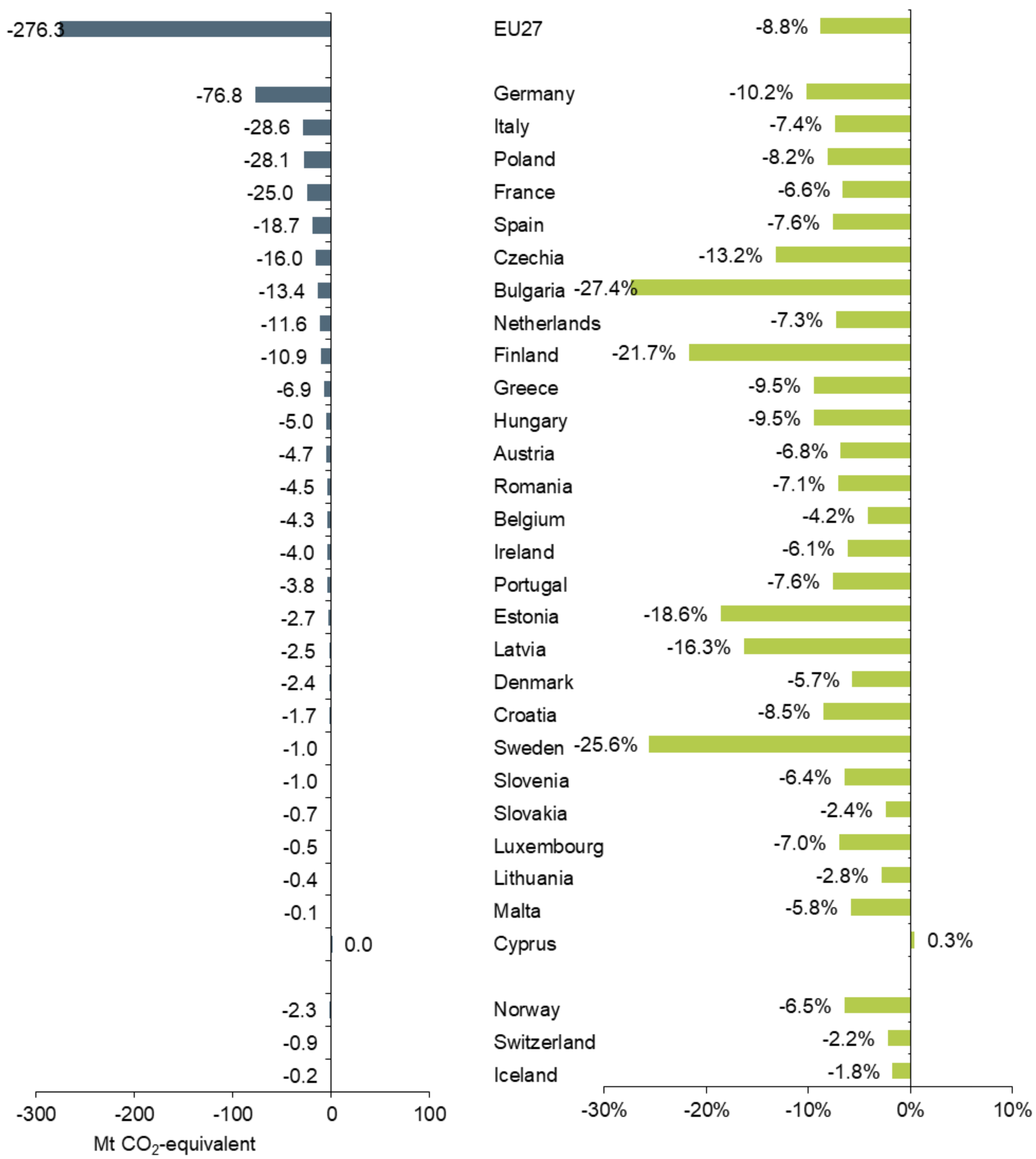
Note: Total GHG emissions with LULUCF including indirect CO_2. Emissions for Croatia relate to the corrected version submitted in April 2024.

Comparing the changes across Member States (Figure 2-4), the largest absolute emission change occurred in Germany, where emissions decreased by 77 Mt CO_2 eq. Apparent decrease in emissions occurred also for Poland (-28 Mt CO_2 eq.) and Italy (-29 Mt CO_2 eq.). The only absolute emission increase occurred in Cyprus (+0.03 Mt CO_2 eq.).

The largest relative declines in emissions compared to the previous year took place in Bulgaria (-27.4 %) and Sweden (-25.6 %). The only relative increase was in Cyprus (+0.3 %).

In the non-EU member countries of the EEA, emissions decreased in Switzerland (-2.2 %, or -0.9 Mt CO_2 eq.), Iceland (-1.8 % or -0.2 Mt CO_2 eq.) and Norway (-6.5 % or -2.3 Mt CO_2 eq.).

Figure 2-4 Member States' emissions, change 2022-2023



Note: Total GHG emissions with LULUCF including indirect CO_2. Emissions for Croatia relate to the corrected version submitted in April 2024.

Consumption of coal, oil, gas and nuclear energy in the following paragraphs are primary energy consumption[5] values from the ETC energy efficiency proxy 2023. (EEA 2024 a)

Member states with decreasing 2022 to 2023 emission trends

Twenty-six Member States experienced emission decreases. The most apparent decrease was seen in Germany. Emissions in Germany decreased by 76.8 Mt CO_2 eq. or 10.2 %. Consumption of solid fossil fuels decreased significantly by 21.0 %, consumption of natural gas decreased by 2.4% and consumption of oil by 5.4 %. Consumption of renewable energies including hydro increased by 2.2% due the changes in wind (+19.0 %) and hydro (+12.9 %) while consumption of solid biofuels decreased (-6.9 %). Emissions from 1.A.1 Energy industries fell the most (-51.4 Mt CO_2 eq. or -20.4 %), followed by 1.A.4 Other sectors (-26.8 Mt CO_2 eq. or -5.6 %). The only energy category where emissions slightly increased was 1.A.5 Other (+0.1 Mt CO_2 eq. or +0.9 %). Emissions of Industrial processes and product use decreased by 19.4 Mt CO_2 eq. (6.6 %), the decrease is driven mainly by 2.A Mineral industry. Emissions from Agriculture decreased by 7.4 Mt CO_2 eq. (-2.0 %). Sinks in LULUCF increased (-20.2 Mt CO_2 eq. or -8.5 %). Emissions decreased in Waste by -1.4 Mt CO_2 eq. (-1.3 %).

In Italy, emissions decreased by 28.6 Mt CO_2 eq. or 7.4 %. Consumption of solid fossil fuels decreased significantly by 30.3 % and consumption of oil decreased by 1.3 % while consumption of gas increased by 10.9 %. Consumption of renewable energy including hydro increased by 1.3 % mainly due the increases in hydro (+41.7 %), wind (+13.7 %) and photovoltaics (+9.2 %) while consumption of solid biofuels decreased (-21.1 %). (-21.1 %), Emissions from 1.A.1 Energy industries decreased the most (-18.5 Mt CO_2 eq. or -19.5 %) while 1.A.3 Transportation decreased (-1.2 Mt CO_2 eq. or -1.1 %). Industrial processes and product use decreased (-10.1 Mt CO_2 eq. or -4.3 %). Emission changes in Agriculture and Waste were rather insignificant (less than -0.1 Mt CO_2 eq. or -0.1 % and 0.2 Mt CO_2 and 0.1 % respectively). LULUCF sink increased (-2.3 Mt CO_2 eq. or -10.6 %).

The largest relative decrease was seen in Bulgaria. Emissions in Bulgaria decreased by 27.4 %. On the sectoral basis, the most apparent change is noted for the Energy sector (-13.1 Mt CO_2 eq. or -29.0 %) where the biggest relative decrease of -48.9 % is reported in 1.A.1 Energy industries. Consumption of energy from renewable sources including hydro increased by 15.6 % in Bulgaria due to increases in photovoltaics (+55.2 %) and wind (+5.7 %) while hydro (-20.1 %) and solid biofuels (-16.8 %) decreased.

Member states with increasing 2022 to 2023 emission trends

The only absolute increase was seen in Cyprus. Emissions in Cyprus increased only by 0.03 Mt CO_2 eq. or 0.3 %. Consumption of solid fossil fuels increased significantly by 31.3 %, consumption of oil increased as well (by 9.6 %) while natural gas consumption decreased by 3.6 %. Consumption of renewable energy including hydro increased by 8.9 % due the changes in photovoltaics (+42.0 %) and wind (-7.0 %). Emissions from 1.A.1 Energy industries increased (+0.01 Mt CO_2 eq. or +0.3 %) followed by an increase in emissions from Industrial processes and product use (-+0.005 Mt CO_2 eq. or +0.3 %) as well as emissions from Agriculture and Waste (+0.002 Mt CO_2 eq. or +0.3 % both). Sink increase in LULUCF was insignificant (less than +0.002 Mt CO_2 eq. or +0.3 %).

2.1.4 Changes in member states GHG emissions 1990 to 2023

Total EU27 GHG emissions including LULUCF and indirect CO_2 in 2023 are estimated to be −38.4 % or −1788 Mt CO_2 eq. below 1990 levels as shown in Figure 2-5. Emissions for most EU27 Member States are lower than in 1990 while emissions in Cyprus, Ireland and Slovenia are higher than in 1990.

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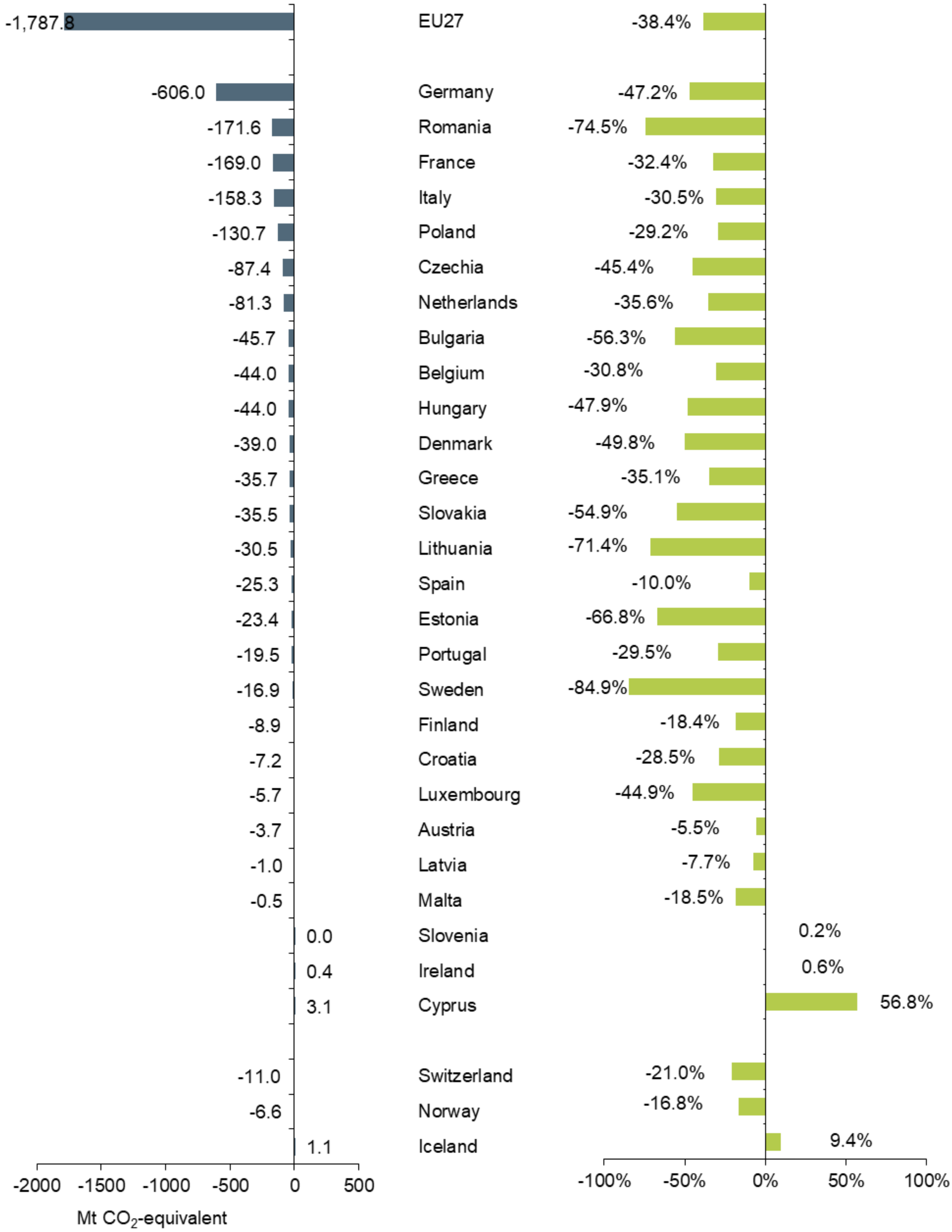
5 Primary energy consumption is calculated as final consumption non energy use subtracted from gross inland consumption.

Figure 2-5 **Member States' emissions change 1990-2023**



Note: Total GHG emissions with LULUCF including indirect CO_2. Emissions for Croatia relate to the corrected version submitted in April 2024.

The largest absolute decrease was in Germany, followed by Romania, France, Italy and Poland which all reduced their GHG emissions by more than 100 Mt CO_2 eq. since 1990. The largest absolute increase was experienced by Cyprus (+3.1 Mt CO_2 eq.) and Ireland with 0.4 Mt CO_2 eq.

The largest relative emission decreases were in Bulgaria, Estonia, Lithuania, Romania, Sweden and Slovakia which all reduced their emissions by more than 50 % compared to 1990. The relative emission decreases of further five Member States are stronger than the EU27 average.

Of the three non-EU member countries of the EEA considered in this report only Iceland had in 2023 higher GHG emissions compared to 1990 level.

2.1.5 Detailed results for the EU27

This section begins with a brief comparison of the effect of including emissions from international aviation and LULUCF in the totals. Table 2-1 summarises the emissions as CO_2 eq. and percentage changes. It should be noted, that in their proxy submissions, a number of Member States used the 2022 value for emissions from international aviation as an approximated value for 2023 as well as for LULUCF sector. Flight and emissions data from Eurocontrol was used to gap-fill international aviation emissions where Member States did not include an estimate. For the EU 2023 proxy, this method was applied to four countries.

Table 2-1 Emissions including international aviation (kt CO_2 eq.)

European Union (EU27)	1990	2022	2023	2023-2022	2023/2022	2023-1990	2023/1990
Total excl. LULUCF incl. indirect CO_2	4 867 243	3 374 743	3 118 576	-256 167	-7.59%	-1 748 667	-35.93%
LULUCF	-217 472	-236 402	-256 557	-20 155	8.53%	-39 085	17.97%
Total incl. LULUCF incl. indirect CO_2	4 649 770	3 138 341	2 862 019	-276 323	-8.80%	-1 787 752	-38.45%
International aviation	54 632	109 723	120 484	10 761	9.81%	65 852	120.54%
Total incl. LULUCF incl. international aviation	4 704 402	3 248 064	2 982 503	-265 562	-8.18%	-1 721 900	-36.60%

Table 2-2 shows the detailed results for the EU27. Summary tables for 2023 for each Member State as submitted by the Member States or gap-filled by EEA for Member States which did not submit their own approximated emissions report are provided in Annex 1.

Table 2-2 Summary table of approximated GHG emissions for 2023 for EU27 (total emissions including indirect CO_2)

Implementing Regulation Article 7: Reporting on approximated Greenhouse Gas Inventories

Member States shall report their approximated greenhouse gas inventories pursuant to Article 26(2) of Regulation (EU) 2018/1999

Year 2023
Submission 2024
Country EU27
Geographical scope Sum of the 27 M

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Unspecified mix of HFCs and PFCs	NF_3	Total
	CO_2 equivalent (kt)								
Total (net emissions)[1]	2227112.31	400370.10	168953.78	57311.62	1270.48	4185.85	198.40	86.69	2859489.22
1. Energy	2291308.17	63350.33	20891.05						2375549.56
A. Fuel combustion (sectoral approach)	2273723.78	23722.32	20869.55						2318315.66
1. Energy industries	686,429	3,928	4,504						694,861
2. Manufacturing industries and construction	365,664	2,283	3,181						371,129
3. Transport (3)	788,039	1,653	7,492						797,184
4. Other sectors	426,575	15,825	5,639						448,040
5. Other	7,016	33	53						7,102
B. Fugitive emissions from fuels	17584.40	39628.01	21.49						57233.90
1. Solid fuels	3,170	24,125	0						27,295
2. Oil and natural gas	14,415	15,503	21						29,939
C. CO_2 transport and storage	-								-
2. Industrial processes and product use	204487.41	1425.84	4950.85	57311.62	1270.48	4185.85	198.40	86.69	273917.12
A. Mineral industry	92,256								92,256
B. Chemical industry	43,602	1,211	2,552	116	334	119	19	1	47,955
C. Metal industry	60,680	133	11	14	165	97	-	-	61,099
D. Non-energy products from fuels and solvent use	7,336	1	4						7,341
E. Electronic Industry				32	482	181	22	86	803
F. Product uses as ODS substitutes				57,127	66	-	64	-	57,257
G. Other product manufacture and use	560	72	2,303	19	223	3,784	-	-	6,961
H. Other	54	9	80	4	1	5	93	-	245
3. Agriculture	9090.09	225326.38	123868.86						358285.32
A. Enteric fermentation		176,762							176,762
B. Manure management		43,899	16,882						60,781
C. Rice cultivation		2,471							2,471
D. Agricultural soils		-	106,612						106,612
E. Prescribed burning of savannas		-	-						-
F. Field burning of agricultural residues		737	209						947
G. Liming	5,254								5,254
H. Urea application	3,260								3,260
I. Other carbon-containing fertilizers	576								576
J. Other	-	1,457	166						1,623
4. Land use, land-use change and forestry[1]	-280309.41	14630.44	9,122						-256556.84
A. Forest land	- 314,212	2,092	3,959						- 308,164
B. Cropland	18,573	544	1,337						20,447
C. Grassland	14,947	3,071	551						18,569
D. Wetlands	14,133	8,597	240						22,970
E. Settlements	25,972	82	2,922						28,976
F. Other land	1,062	1	72						- 755
G. Harvested wood products	- 40,815	-							- 38,924
H. Other	30	244	0						274
5. Waste	2536.05	95637.11	10120.90						108294.06
A. Solid waste disposal	-	73,787							73,787
B. Biological treatment of solid waste		5,036	1,876						6,911
C. Incineration and open burning of waste	2,521	563	476						3,560
D. Waste water treatment and discharge		16,243	7,741						23,985
E. Other	15	9	27						51
6. Other *(as specified in summary 1.A)*	-	-	-	-	-	-	-	-	NO

Memo items:									
International bunkers	239,870	776	2,327						242972.96
Aviation	119,183	80	1,221						120483.76
Navigation	120,687	696	1,106						122489.18
CO_2 emissions from biomass	465,392								462443.28
CO_2 captured	52								51.72
Indirect CO_2 [2]	2,530								
Total CO_2 equivalent emissions without land use, land-use change and forestry									3116046.06
Total CO_2 equivalent emissions with land use, land-use change and forestry									2859489.22
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry									3118575.66
indirect CO_2, with land use, land-use change and forestry									2862018.82

2.2 Sectoral results

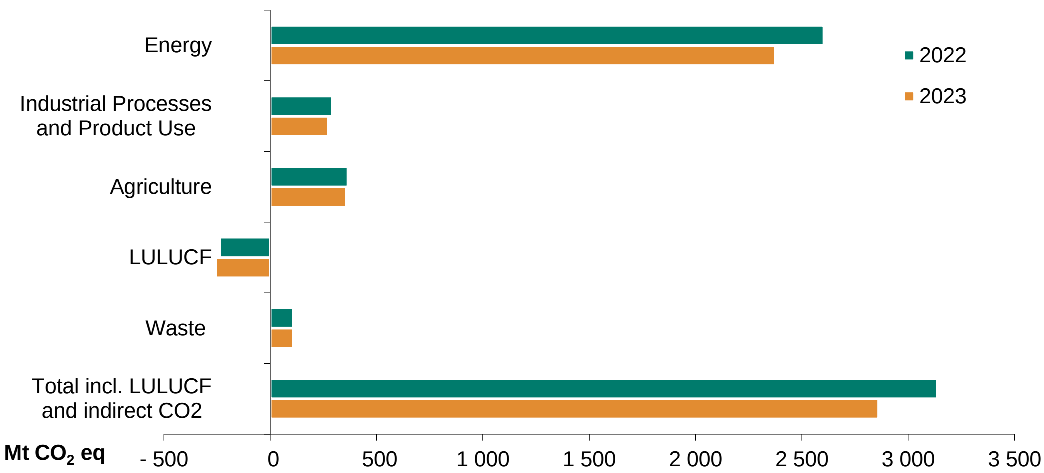
Table 2-3 and Figure 2-6 show the changes between 2022 and 2023 at the sectoral level for the EU27.

Table 2-3 Emissions by sector, change 2022-2023

Change 2022 / 2023, EU27	Mt CO_2 eq.	%
Energy	-228.3	-8.8%
Industrial Processes and Product Use	-17.9	-6.1%
Agriculture	-7.4	-2.0%
LULUCF	-20.2	-8.5%
Waste	-1.4	-1.3%
Total incl. LULUCF incl. indirect CO_2	-276.3	-8.8%

Source: The EEA's ETC CM, based on the 2023 Member States' GHG inventories submitted to UNFCCC for the years 1990-2022 and proxy estimates for 2023.

Figure 2-6 Emissions by sector, EU27, 2022-2023



Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

On a sectoral basis, the largest absolute emission change occurred in the Energy sector (i.e. all combustion activities and fugitive emissions from energy). GHG emissions decreased by 228 Mt CO_2 eq. (-8.8 %) across the EU. More detailed explanations for the trends in the energy sector are provided in section 2.2.1.

The greenhouse gas emissions from Industrial Processes and Product Use decreased by 18 Mt CO_2 eq. (−6.1 %), the agricultural sector experienced a decrease of 7.4 Mt CO_2 eq. (-2.0 %), LULUCF net sink increased by 20 Mt CO_2 eq. and the waste sector indicated a decrease of 1.4 Mt CO_2 eq. (−1.3 %).

2.2.1 Energy

Emissions from the energy sector contributed about 83.0 % of total EU emissions in 2022 and are expected to have the same share of 83.0 % of total EU emissions for 2023. Emissions from fuel combustion saw a decrease of 226 Mt CO_2 eq. or 8.9 % compared to 2022. Table 2-4 shows that the largest change in fuel combustion emissions occurred in 1.A.1 Energy Industries with a decrease of 172 Mt CO_2 eq. (-19.8 %), followed by a decrease in the sector 1.A.4 Other sectors (-27 Mt CO_2 eq. or -5.6 %). Another decrease occurred also in 1.A.2 Manufacturing Industries and Construction (-21 Mt CO_2 eq. or -5.5 %), 1.A.3

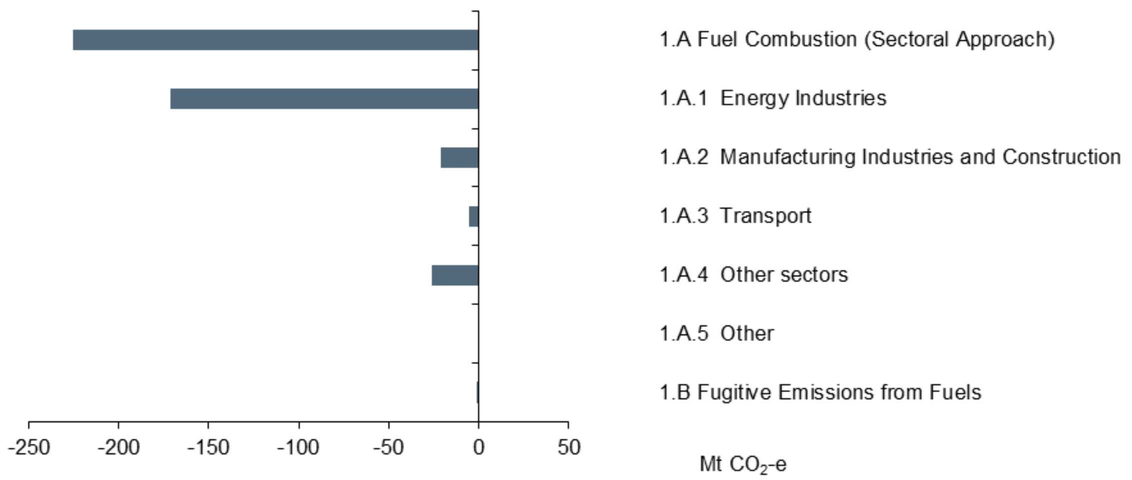
Transport (-6 Mt CO_2 eq. or -0.8 %) and 1.B Fugitive Emissions from Fuels (-2 Mt CO_2 eq. or -3.6 %). Emissions in 1.A.5 Other has stayed almost the same.

Table 2-4 Energy sector emissions, change 2022-2023

Change 2022 / 2023, EU27	Mt CO_2eq	%
1.A Fuel Combustion (Sectoral Approach)	-226.1	-8.9%
1.A.1 Energy Industries	-171.8	-19.8%
1.A.2 Manufacturing Industries and Construction	-21.5	-5.5%
1.A.3 Transport	-6.1	-0.8%
1.A.4 Other sectors	-26.8	-5.6%
1.A.5 Other	0.1	0.9%
1.B. Fugitive Emissions from Fuels	-2.2	-3.6%

Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

Figure 2-7 Energy sector emissions, EU27 change 2022-2023



Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

The largest increase in emissions for 1.A Fuel Combustion on Member States level was noted for Czechia (+0.5 Mt CO_2 eq.), Cyprus (+0.02 Mt CO_2 eq.). The largest emission decrease was in Germany (− 69.7 Mt CO_2 eq.) followed by Italy (−25 Mt CO_2 eq.) and Poland (−24 Mt CO_2 eq.).

Going to more detail in the subcategory 1.A.1 Energy Industries, the largest reduction was in Germany (−51 Mt CO_2 eq.), followed by the Poland (−21 Mt CO_2 eq.), Italy (−18 Mt CO_2 eq.) and Spain (−13.7 Mt CO_2 eq.). The increases were less significant, with the largest change noted for Cyprus (+0.01 Mt CO_2 eq.) and Malta (+0.004 Mt CO_2 eq.).

In the sector 1.A.2 Manufacturing Industries and Construction, the largest decrease was in Germany (−7.8 Mt CO_2 eq.), followed by Spain and France (−3.2 Mt CO_2 eq.). The emission increases were less significant, the largest one occurred in Czechia with 0.3 Mt CO_2 eq. increase.

The largest increase in emissions from 1.A.3 Transport was in Czechia (+1.5 Mt CO_2 eq.), Poland (+1.4 Mt CO_2 eq.) and Netherland (+1.1 Mt CO_2 eq.). The most significant decrease was in France (-4.1 Mt CO_2 eq.) and Germany (-2 Mt CO_2 eq.).

In 1.A.4 Other Sectors (which include residential and commercial sectors) the largest increase in emissions was in Spain (+2.6 Mt CO_2 eq.), in Greece and Estonia, which is smaller than 0.1 Mt CO_2 eq. The largest decrease occurred in Germany (-8 Mt CO_2 eq.), Italy (-5.5 Mt CO_2 eq.) and the France (-73.9 Mt CO_2 eq.).

Changes in the sector 1.A.5 Other were less than ±0.3 Mt CO_2 eq. in all Member States.

For the subcategory 1.B Fugitive Emissions from fuels, the highest decrease was in Poland (-0.9 Mt CO_2 eq.) and the highest increase in France (+0.05 Mt CO_2 eq.).

2.2.2 Industrial Processes and Product Use

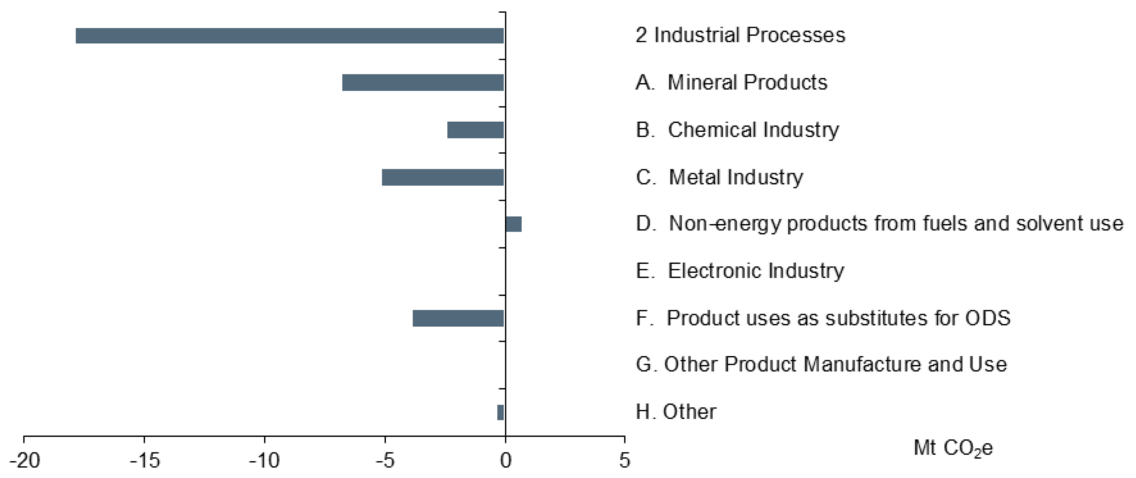
The Sector Industrial Processes and Product Use (IPPU) contributes to about 9 % of total EU emissions and is the third most important source after energy and agriculture. Emissions from Industrial Processes decreased by 18 Mt CO_2 eq. in the EU (-6.1 %). Table 2-5 and Figure 2-8 show the subsector contribution to this trend in emissions. The largest emission decrease occurred in the subsector 2.A Mineral products followed by the 2.C Metal industry, 2.F Product uses as substitutes for ODS and 2.A Mineral Products. The only increase occurred in the subcategory 2.D Non-energy products from fuels and solvent use.

Table 2-5 Industrial Processes and Product Use emissions, change 2022-2023

Change 2022 / 2023, EU27	Mt CO_2 eq.	%
2 Industrial Processes	-17.9	-6.1%
A. Mineral Products	-6.8	-6.9%
B. Chemical Industry	-2.5	-4.9%
C. Metal Industry	-5.2	-7.8%
D. Non-energy products from fuels and solvent use	0.8	11.5%
E. Electronic Industry	-0.0	-2.4%
F. Product uses as substitutes for ODS	-3.9	-6.4%
G. Other Product Manufacture and Use	0.1	0.9%
H. Other	-0.4	-59.9%

Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

Figure 2-8 Industrial Processes and Product Use emissions, EU27, change 2022-2023



Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

In only four of the EU27 Member States emissions from IPPU increased. The largest increase of IPPU emissions was in Croatia (less than +0.2 Mt CO_2 eq.) while the largest decreases were in Germany (−5 Mt CO_2 eq.) followed by Poland (−2.6 Mt CO_2 eq.) and France (−2.5 Mt CO_2 eq.).

In the subcategory 2.A Mineral Products, emissions decreased in the EU by 6.8 Mt CO_2, the highest decrease is in Germany (-2.78 Mt CO_2) and Poland (-1.4 Mt CO_2), the largest increase in Greece is less than +0.42 Mt CO_2 eq.

Emissions from 2.B Chemical Products decreased in the EU (-2.5 Mt CO_2 eq. or −4.9 %). The largest decrease was in the Poland (-1.1 Mt CO_2 eq.) while the largest increase was in Hungary (less than +0.4 Mt CO_2 eq.).

Emissions from 2.C Metal Industry decreased by -5.2 Mt CO_2 eq. or -7.8 % with the largest decrease in Romania (-1.7 Mt CO_2 eq.) while the largest increase occurred in Slovakia (less than +0.4 Mt CO_2 eq.)

The subsector 2.D Non-energy Products from Fuels and Solvent Use has had less significant increase in the emissions (+0.76 Mt CO_2 eq. or +11.5 %). The highest increase was in France (+0.3 Mt CO_2 eq.) and highest decrease in Germany (-0.1 Mt CO_2 eq.).

The subsector 2.E Electronic Industry showed insignificant absolute emission changes for the EU (-0.02 Mt CO_2 eq. or -2.4 %). Emissions changes for all the Member States were within ±0.03 Mt CO_2 eq.

The subsector 2.F Product uses as substitutes for ODS saw emissions decrease by 3.9 Mt CO_2 eq. (−6.4 %). In six Member States emissions increased in this source category, in 18 Member States emissions decreased and two Member States report no changes. The largest decrease of emissions was in Spain, where 2.F emissions fell by 1.5 Mt CO_2 eq. and in Italy (−0.7 Mt CO_2 eq.). The increases were minor; the highest increase was in Poland (+0.1 Mt CO_2 eq.).

Emissions from 2.G Other Product Manufacture and Use increased very slightly for the EU (less than 0.1 Mt CO_2 eq. or 0.9 %). The greatest emission decrease is reported by Germany (−0.2 Mt CO_2 eq.). The highest increase occurred in France (+0.4 Mt CO_2 eq.) Emission changes of the other Member States are less than ±0.1 Mt CO_2 eq.

The decrease of emissions from 2.H Other is very low by absolute terms (−0.4 Mt CO_2 eq.) but significant in relative terms (−59.9 %).

2.2.3 Agriculture

Agriculture (excluding LULUCF) contributes to 12 % of European GHG emissions. Emissions from agriculture decreased by 7.4 Mt CO_2 eq. or 2.0 % since 2022. The largest greenhouse gas emitting activities within the sector are CH_4 from livestock and N_2O from soils. Enteric fermentation and soils contributed about 49 % and 30 % of the sector's emissions respectively. As shown in Table 2-6 and Figure 2-9 the decrease in agriculture sector emissions is largely driven by decreased emissions from 3.A Enteric fermentation, 3.D Agricultural soils and 3.B Manure management, but 3.G Liming and 3.I Other carbon-containing fertilizers contributed to this decrease as well.

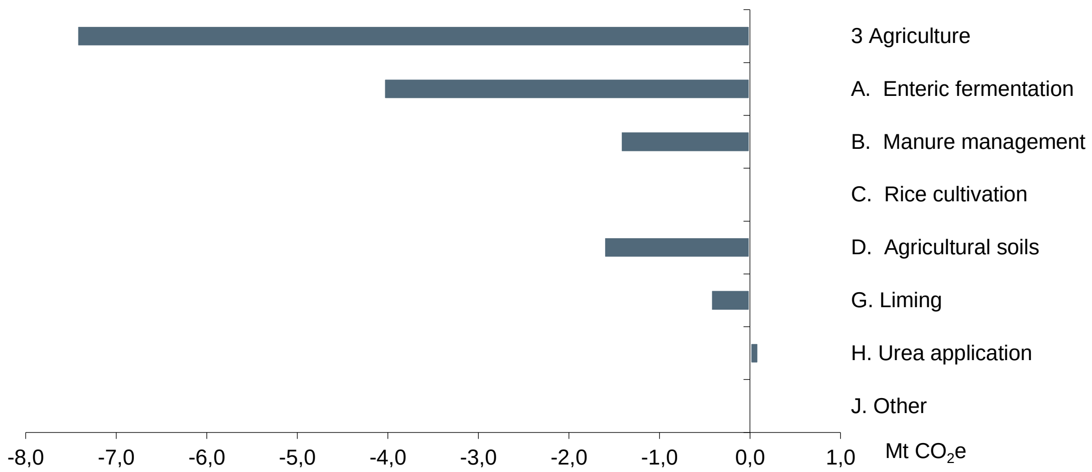
Table 2-6 and Figure 2-9 show the subsector 2022-2023 change, with CH_4 and N_2O emissions shown as CO_2 equivalents (Mt CO_2 eq.).

Table 2-6 Agriculture sector emissions, change 2022-2023

Change 2022/2023, EU27	Mt CO_2 eq.	%
3 Agriculture	-7.4	-2.0%
A. Enteric fermentation	-4.1	-2.2%
B. Manure management	-1.4	-2.3%
C. Rice cultivation	-0.0	-1.0%
D. Agricultural soils	-1.6	-1.5%
E. Prescribed burning of savannas	0.0	0.0%
F. Field burning of agricultural residues	0.1	7.1%
G. Liming	-0.4	-7.6%
H. Urea application	0.1	3.0%
I. Other carbon-containing fertilizers	-0.0	-6.8%
J. Other	0.0	0.0%

Source: The EEA's ETC CM, based on the 2024Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

Figure 2-9 Agriculture sector emissions, EU27, change 2022-2023



Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022 and proxy estimates for 2023.

Emissions from Enteric Fermentation decreased by 4. Mt CO_2 eq. or 2.2 %. The largest decrease was in Ireland (-1.5 Mt CO_2 eq.). Emissions of CH_4 and N_2O from manure management contribute to about 17 % of the agriculture sector and have decreased by 1.4 Mt CO_2 eq. or -2.3 %. The largest decrease was in Ireland (-0.3 Mt CO_2 eq.). Agricultural soils have decreased by 1.6 Mt CO_2 eq. or -1.5 %. The largest decrease was seen in Ireland (-0.57 Mt CO_2 eq.) and Czechia (-0.55 Mt CO_2 eq.). The largest increase was in Slovakia (+0.2 Mt CO_2 eq.).

2.2.4 Land use, land-use change and forestry

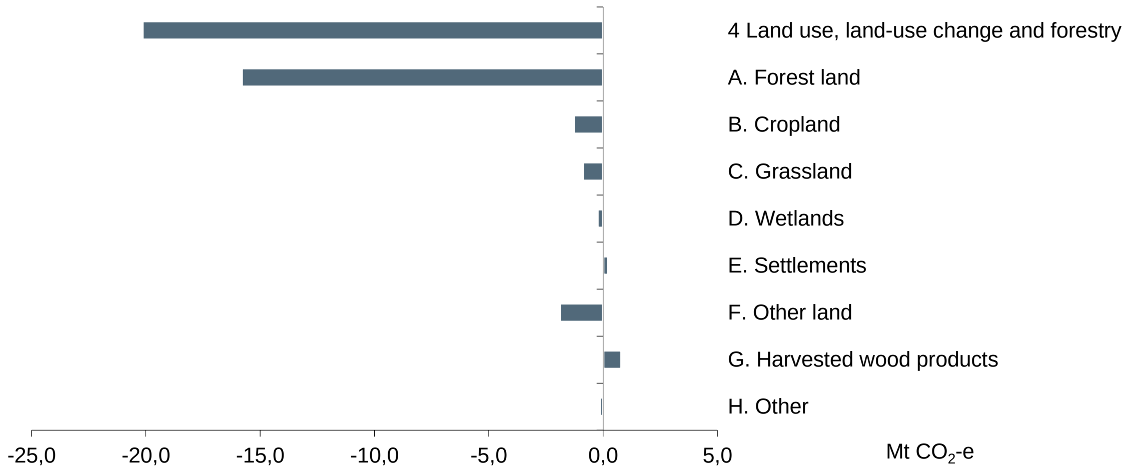
In the EU, the LULUCF sector has higher removals by sinks than emissions by sources, resulting in a net carbon sink. LULUCF removals increased between 2022 and 2023 (-20.2 Mt CO_2 eq. or 8.5 %). Table 2-7 and Figure 2-10 show the subsector contributions to this trend. The trends of 4.A Forest land significantly dominate the LULUCF sector.

In 2023, twenty Member States reported net removals within the LULUCF sector while seven Member States reported net emissions. The largest increase of removals was noted for Czechia (−6.2 Mt CO_2 eq.) and Finland (−5.8 Mt CO_2 eq.), on the contrary the largest increase in emissions was seen in Ireland (+1.6 Mt CO_2 eq.).

Table 2-7 LULUCF sector emissions and removals, change 2022-2023

Change 2022/2023, EU27	Mt CO_2 eq.	%
4 Land use, land-use change and forestry	-20.2	-8.5%
A Forest land	-15.8	-5.4%
B Cropland	-1.3	-5.9%
C Grassland	-0.9	-4.6%
D Wetlands	-0.3	-1.1%
E Settlements	0.2	0.8%
F Other land	-1.9	-166.7%
G Harvested wood products	0.8	2.1%
H Other	-0.1	33.7%

Figure 2-10 LULUCF sector emissions and removals, EU27, change 2022-2023



2.2.5 *Waste*

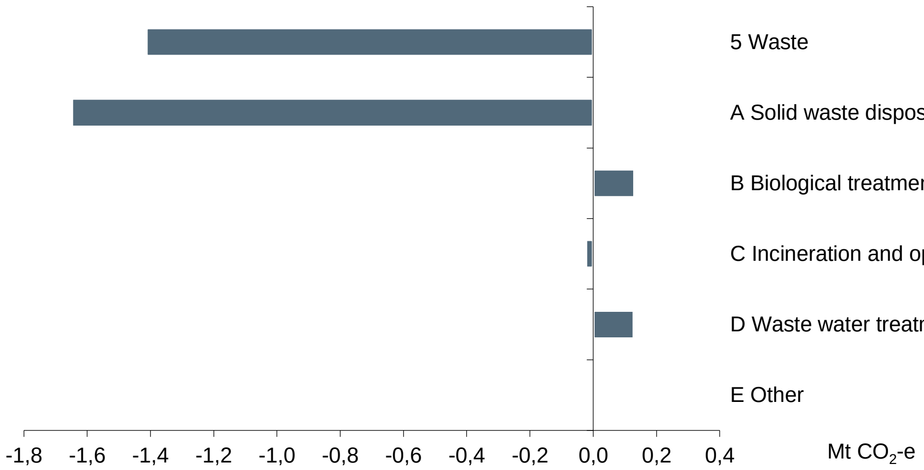
The Waste sector contributes to about 3.6 % of European emissions. Waste related emissions continue to decrease reflecting the large relative proportion of emissions from solid waste disposal (77 % share of Waste emissions) and the ongoing effect of restrictions on landfilling of organic degradable waste that was implemented decades ago.

Emissions from the Waste sector decreased by −1.4 Mt CO_2 eq. compared to 2022. Table 2-8 and Figure 2-11 show the subsector contributions to this trend in emissions.

Table 2-8 Waste sector emissions, change 2022-2023

Change 2022/2023, EU27	Mt CO_2 eq.	%
5 Waste	-1.4	-1.3%
A Solid Waste Disposal	-1.7	-2.2%
B Biological Treatment of Solid Waste	0.1	1.9%
C Incineration and Open burning of Waste	-0.0	-0.6%
D Waste Water Treatment and Discharge	0.1	0.5%
E Other	0.0	-1.5%

Figure 2-11 Waste sector emissions, EU27, change 2022-2023



The largest decrease of waste emissions was noted for Germany (-0.14 Mt CO_2 eq.). The trends of 5.A Solid Waste emissions generally dominate the waste sector. 16 Member States decreased emissions from solid waste (largest decrease in Germany with −0.18 Mt CO_2 eq.) while eight Member States had an increase in emissions (the largest one in Italy with less than +0.2 Mt CO_2 eq.) For the remaining Member States constant emissions were estimated.

2.3 ETS versus ESR

Within the European Union there are three policy instruments for achieving the GHG emission reductions: One part is covered by the EU Emissions Trading System (ETS) while the other is the Effort Sharing Regulation (ESR) which replaced Effort Sharing Decision (ESD) since 2021. The LULUCF Regulation covers emissions and reductions in the LULUCF sector.

ESR emissions are calculated by deducting ETS emissions and CO_2 emissions from domestic aviation from total emissions including indirect CO_2 emissions. LULUCF is excluded from ESR emissions.

$$\boldsymbol{E_{ESR} = E_{total} - E_{Biomass,CO2} - E_{ETS} - E_{1A3a,CO2}}$$

$\boldsymbol{E_{ESR}}$	Emission under Effort Sharing Regulation
$\boldsymbol{E_{total}}$	Total emissions excl. LULUCF incl. indirect CO_2
$\boldsymbol{E_{Biomass,CO2}}$	Negative emissions from CO_2 captured from biomass combustion and transferred to long-term storage
$\boldsymbol{E_{ETS}}$	Emissions included in the ETS
$\boldsymbol{E_{1A3a,CO2}}$	CO_2 emissions from domestic aviation

Table 2-9 shows total (excluding LULUCF, including indirect CO_2), ETS and Effort Sharing emissions per country. ETS emissions are taken from the EEA ETS data viewer (EEA 2024 c) for stationary installations. ESR emissions are calculated as described in the formula above. Relative changes in emissions between the years 2022 and 2023 can be seen on the right.

Table 2-9 Total, ETS and ESD emissions 2022 and 2023, kt CO_2 eq.

MS	2022 GHG emissions			2023 GHG emissions			Change 2023 versus 2022		
	Total	ETS	ESR	Total	ETS	ESR	Total	ETS	ESR
AT	72 844	26 626	46 188	68 170	24 414	43 725	-6.4%	-8.3%	-5.3%
BE	103 576	39 722	63 846	99 274	35 401	63 866	-4.2%	-10.9%	0.0%
BG	58 484	33 936	24 532	45 075	21 635	23 422	-22.9%	-36.2%	-4.5%
CY	8 779	4 328	4 449	8 809	4 343	4 465	0.3%	0.3%	0.4%
CZ	117 688	57 045	60 631	107 917	46 671	61 246	-8.3%	-18.2%	1.0%
DE	749 965	353 962	394 973	673 953	289 379	383 446	-10.1%	-18.2%	-2.9%
DK	42 055	11 214	30 723	39 684	9 244	30 316	-5.6%	-17.6%	-1.3%
EE	13 952	8 407	5 539	11 289	5 260	6 024	-19.1%	-37.4%	8.7%
ES	294 201	96 303	194 864	275 699	81 124	191 296	-6.3%	-15.8%	-1.8%
FI	45 700	19 021	26 544	40 629	15 367	25 127	-11.1%	-19.2%	-5.3%
FR	395 674	84 935	306 156	372 858	70 598	297 830	-5.8%	-16.9%	-2.7%
EL	78 271	31 630	46 251	71 207	25 466	45 320	-9.0%	-19.5%	-2.0%
HR	24 552	6 455	18 071	22 873	6 567	16 276	-6.8%	1.7%	-9.9%
HU	59 535	15 559	43 961	54 249	13 437	40 793	-8.9%	-13.6%	-7.2%
IE	60 605	14 686	45 897	55 007	12 189	42 794	-9.2%	-17.0%	-6.8%
IT	410 289	136 295	271 510	383 895	114 774	266 631	-6.4%	-15.8%	-1.8%
LT	18 942	5 066	13 874	18 309	4 752	13 555	-3.3%	-6.2%	-2.3%
LU	8 192	1 134	7 058	7 797	889	6 907	-4.8%	-21.6%	-2.1%
LV	10 131	1 690	8 436	9 984	1 730	8 253	-1.4%	2.3%	-2.2%
MT	2 263	797	1 466	2 130	797	1 333	-5.8%	0.1%	-9.1%
NL	153 384	68 507	84 845	143 004	58 879	84 097	-6.8%	-14.1%	-0.9%
PL	380 509	184 146	196 235	353 031	152 449	200 432	-7.2%	-17.2%	2.1%
PT	56 382	16 191	39 775	52 822	12 759	39 611	-6.3%	-21.2%	-0.4%
RO	109 715	28 161	81 355	105 229	23 835	81 213	-4.1%	-15.4%	-0.2%
SE	45 249	17 658	27 291	44 218	17 008	26 884	-2.3%	-3.7%	-1.5%
SI	15 615	4 861	10 752	14 638	4 582	10 055	-6.3%	-5.7%	-6.5%
SK	37 052	17 418	19 632	36 825	16 994	19 830	-0.6%	-2.4%	1.0%
EU27	**3 374 743**	**1 285 753**	**2 075 993**	**3 118 576**	**1 070 545**	**2 034 734**	**-7.6%**	**-16.7%**	**-2.0%**
IS	4 666	1 875	2 767	4 521	1 813	2 687	-3.1%	-3.3%	-2.9%
NO	48 879	22 574	25 243	46 601	21 333	24 183	-4.7%	-5.5%	-4.2%

Note: Only emissions from stationary installations are included in these ETS data hence emissions from aviation are excluded.
Total emissions are without LULUCF, including indirect CO_2.

Source: The EEA's ETC CM, based on the 2024 Member States' GHG inventories submitted to the EU for the years 1990-2022, proxy estimates for 2023 totals. ETS data is from EUTL (verified emissions for 2022 and 2023, not from the Member States proxies). Value for domestic aviation (which is used for calculation of ESR emissions) was obtained from Eurocontrol. Emissions for Croatia relate to the corrected version submitted in April 2024.

Total emissions excluding LULUCF and including indirect CO_2 changed by -7.6 % within the EU between 2022 and 2023. Emissions decreased in both the ETS sector and the ESR sector but the decrease in the ETS sector (-16.7 %) is far more significant than in the ESR sector (-2.0 %). Figure 2-12 illustrates all emission trend changes.

In absolute terms, the total emission decrease in the EU was -256 Mt CO_2 eq. The decrease of 215 Mt CO_2 eq. occurred in the ETS sectors and 41 Mt CO_2 eq. in the ESR sector.

At Member State level the trend change in emissions separated between ETS and ESR looks similar. ETS emissions decreased in 23 Member States. The largest absolute decrease was experienced in Germany (−64.6 Mt CO_2 eq.), followed by Poland (−31.7 Mt CO_2 eq.). Bulgaria saw the highest relative ETS emission decrease (−36.2 %).

In four EU Member States ETS emissions increased. The largest absolute increase was experienced in Croatia (+0.1 Mt CO_2 eq.). Latvia saw the highest relative ETS emission increase (+2.3 %).

ESR emissions decreased in 21 Member States. The largest absolute decrease was experienced in Germany (−11.5 Mt CO_2 eq.), followed by France (−8.3 Mt CO_2 eq.) and Italy (−4.9 Mt CO_2 eq.).

Six Member States saw increases in ESR emissions. The largest absolute ESR emission increase was in Poland (+4.2 Mt CO_2 eq.) and the largest relative increase was in Estonia (+8.7 %).

Increases of both ETS and ESR emissions can be observed only for Cyprus. On the other hand, there are 18 Member States which had decreases in both ETS and ESR emissions.

In five Member States emissions in the ETS sector decreased while emissions in the ESR sector increased. A contrasting development can be observed in three Member States, where ETS emissions increased and ESR emissions decreased.

The emission trends both in the ETS and the ESR resemble the emission changes discussed in chapter 2.2.

Figure 2-12 ETS and Effort Sharing emissions, change 2022-2023

3 Performance of last year's EU proxy

National GHG inventories are required to fulfil certain principles as laid out in the UNFCCC reporting guidelines for GHG inventories: inventories must be transparent, consistent, comparable, complete and accurate (TCCCA). The IPCC Guidelines (IPCC, 2006) recommends Parties to perform QA/QC procedures that are important information to enable continuous improvement to inventory estimates. Through the quantification of deviations at the source level and for the inventory as a whole, improvements can be prioritized. Thus, Parties may change methodologies in order to improve their greenhouse gas estimates at source level (e.g. moving from Tier 2 to Tier 3). Such methodological changes at Member States level cannot be captured in the calculation of the approximated GHG inventory for the EU. On-going quality improvements in Member States' inventories to take effect in next year's official submissions to UNFCCC are therefore a source of uncertainty for the EU proxy inventory.

This section compares the differences between the previous proxy estimates and the subsequent official inventory submissions. Since the previous proxy estimates emphasised total emissions including indirect CO_2 and excluding LULUCF, the total emissions mentioned in this chapter include indirect CO_2 and exclude LULUCF as well.

Last year's proxy GHG estimates for 2022 underestimated the GHG emissions (Total EU emissions including indirect CO_2, excluding LULUCF) for the EU by 15.2 Mt CO_2 eq. or 0.5 %.

The effect of Member States' recalculations of GHG estimates and methodological improvements dominate the differences of the 2022 proxy emission estimates compared to 2022 emissions officially reported in 2024. After taking these recalculations into account difference between the proxy GHG inventory for 2022 and final GHG inventory submission was 0.1 % for total emissions for the EU.

3.1 Difference between MS proxy and final GHG inventories

The proxy submissions by Member States closely mirrored the increase in official emissions as reported to the EU this year. The differences per Member State given in Table 3-1 arise from several factors: different methodologies and data with varying precision used across the Member States (resp. ETC CM for gap-filling); the lack of updated (t-1) activity data for some key emission sources; and, from Member States' own recalculations of GHG estimates and methodological improvements which mainly cannot be reflected in the approximated data where usually constant methodologies and emission factors are assumed.

The largest deviations in relative terms occurred for Malta (proxy 3.8% lower), followed by Bulgaria (proxy 3.4 % lower). In absolute terms the deviations were highest for France (overestimate by proxy of 8.1 Mt CO_2 eq.), Italy (overestimate by proxy of 8.0 Mt CO_2 eq.) and Germany (underestimate by 4.4 Mt CO_2 eq.). By comparing the percentage changes in emission levels 2021/2022 as derived from the 2023 proxy GHG inventory[6] on the one hand and from the 2024 official GHG inventory submissions to UNFCCC on the other, the deviations are in almost all cases in the same order of magnitude, see Figure 3-1. Also the direction of the emission trend was estimated correctly.

After taking into account recalculations, the relative differences were largest for Malta (-5.4 %), Bulgaria (-2.9 %) and Estonia (+2.7 %).

[6] The 2021 value used in this recalculation comes from 2023 submission.

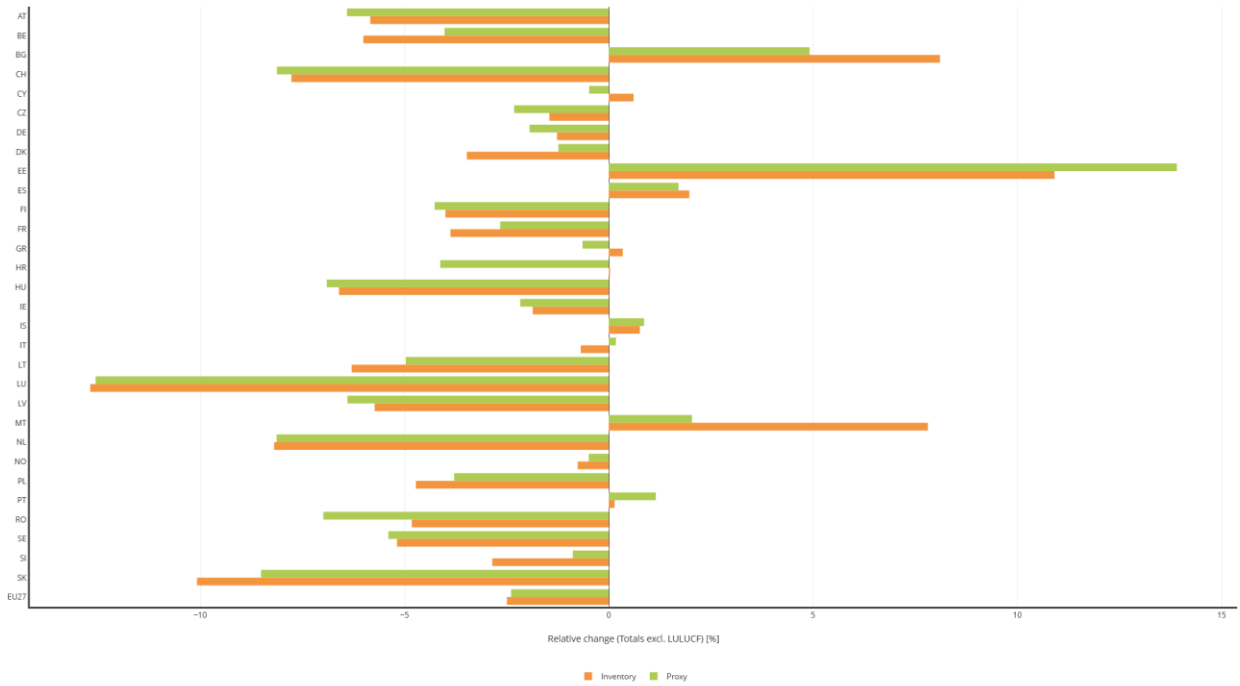
Table 3-1 Difference per Member State for year 2022 between proxy and final GHG inventories

MS	Inventory 2022 (Submission 2024)	Proxy 2022 (Submission 2023)	Deviation 2022		Recalcu-lations	Deviation 2022 cleared of impact of recalculations	Proxy calculated by
			kt CO_2 eq.			%	
AT	72 844	72 565	-279	-0.4	-0.2	-0.6	MS
BE	103 576	106 492	2 915	2.8	-0.7	2.1	MS
BG	58 484	56 639	-1 845	-3.2	0.2	-2.9	ETC CM
CY	8 779	8 702	-76	-0.9	-0.2	-1.1	MS
CZ	117 688	116 278	-1 410	-1.2	0.3	-0.9	MS
DE	749 965	745 614	-4 351	-0.6	-0.1	-0.7	MS
DK	42 055	43 310	1 255	3.0	-0.6	2.3	MS
EE	13 952	14 369	418	3.0	-0.3	2.7	MS
ES	294 201	293 778	-423	-0.1	-0.1	-0.3	MS
FI	45 700	45 816	116	0.3	-0.5	-0.3	MS
FR	395 674	403 771	8 098	2.0	-0.8	1.3	MS
EL	78 271	76 991	-1 280	-1.6	0.7	-1.0	MS
HR	24 552	23 438	-1 114	-4.5	5.1	-0.8	MS
HU	59 535	59 785	250	0.4	-0.7	-0.3	MS
IE	60 605	60 764	159	0.3	-0.6	-0.3	MS
IT	410 289	418 325	8 036	2.0	-1.1	0.9	MS
LT	18 942	19 284	341	1.8	-0.4	1.4	MS
LU	8 192	8 211	19	0.2	-0.1	0.1	MS
LV	10 131	10 051	-80	-0.8	0.1	-0.7	MS
MT	2 263	2 177	-86	-3.8	-1.6	-5.4	MS
NL	153 384	154 023	639	0.4	-0.3	0.1	MS
PL	380 509	384 801	4 292	1.1	-0.1	1.0	MS
PT	56 382	57 174	792	1.4	-0.4	1.0	MS
RO	109 715	107 339	-2 376	-2.2	-0.1	-2.3	MS
SE	45 249	45 237	-12	0.0	-0.2	-0.2	MS
SI	15 615	15 965	350	2.2	-0.2	2.0	MS
SK	37 052	37 757	705	1.9	-0.2	1.7	MS
EU27	**3 374 743**	**3 388 659**	**13 916**	**0.4**	**-0.3**	**0.1**	**ETC CM**

Note: Total GHG emissions without LULUCF including indirect CO_2

Source: Member States submissions to the EU and proxy estimates for 2022. Emissions for Croatia relate to the corrected version submitted in April 2024.

Figure 3-1 Relative difference between proxy and submitted inventories by Member State 2021/2022



Note: Total GHG emissions without LULUCF including indirect CO_2

Source: Member States submissions to UNFCCC and proxy estimates for 2022.

3.2 Sectoral differences between proxy and final GHG inventories

At the sectoral level, the largest difference between the proxy and the final GHG inventory in absolute terms was in 1.A Fuel combustion [Energy] (+10.5 Mt CO_2 eq.) and 1.A.4 Other sectors [Energy] +7.5 Mt CO_2 eq.). The next largest differences were in 1.A.2 Manufacturing Industries and Construction [Energy] (+6.0 Mt CO_2 eq.) and 2.F Product uses as ODS substitutes [IPPU] (+5.4 Mt CO_2 eq.). After accounting for recalculation effects, the differences for most of these sectors are significantly smaller. Sectors with highest relative deviation after allowing for recalculation effects were 2.H Other [IPPU] (+53.3 %), 2.D Non-energy products [IPPU] (+22.6 %), 2.B Chemical industry [IPPU] (-10.7 %) and 3.H Urea application [Agriculture] (+10.3 %), see Table 3-2. Therefore, largest relative deviations occur mainly in “other” categories which are compound items and usually comparatively low in absolute emission levels.

Changes in the data reported as proxy in last year and as final in 2024 submissions to the EU are mostly affected by the sources of the activity data. The data available during preparation of the proxy inventory for the Energy sector are based on preliminary data and energy balances provided by the statistical offices. For the inventory submitted in 2024 however, final energy balances were used. In case of the IPPU sector, data for the year X-1 is not usually available when preparing the approximated inventories, thus extrapolation and interpolation of the activity data are mostly used. In Agriculture and Waste there is usually the case that activity data are partly available (for instance population data), however statistical methods are also partly applied to estimate the proxy inventory.

Table 3-2 Difference per sector for year 2022 between proxy and final GHG inventories

Sector	Inventory 2022 (Submission 2024)	Proxy 2022 (Submission 2023)		Deviation 2022	Recalcu-lations	Deviation 2022 cleared of impact of recalculations
			kt CO_2eq			%
Total incl. indirect CO_2 excl. LULUCF	**3 296 472**	**3 311 667**	**15 196**	**0.5**	**-0.3**	**0.1**
1 Energy	**2 549 392**	**2 561 285**	**11 892**	**0.5**	**-0.4**	**0.1**
1.A Fuel combustion	2 490 472	2 500 977	10 505	0.4	-0.4	0.0
1.A.1 Energy industries	841 965	839 213	-2 752	-0.3	0.1	-0.2
1.A.2 Manufacturing industries	388 112	394 109	5 997	1.5	-2.1	-0.6
1.A.3 Transport	785 375	784 791	-585	-0.1	-0.4	-0.5
1.A.4 Other sectors	468 284	475 822	7 539	1.6	0.3	1.9
1.A.5 Other	6 732	7 042	310	4.6	-3.3	1.3
1.B Fugitive emissions	58 921	60 308	1 387	2.4	0.3	2.7
2 Industrial processes & product use	**282 247**	**283 698**	**1 451**	**0.5**	**0.0**	**0.5**
2.A Mineral products	95 652	96 258	606	0.6	0.0	0.7
2.B Chemical industry	48 977	43 717	-5 260	-10.7	14.9	4.2
2.C Metal production	65 683	65 682	-1	0.0	0.1	0.1
2.D Non-energy products	6 414	7 867	1 453	22.6	-7.5	15.1
2.E Electronic Industry	823	749	-74	-9.0	-2.1	-11.2
2.F Product uses as ODS substitutes	56 582	61 935	5 353	9.5	-10.8	-1.3
2.G Other product manufacture and use	6 681	7 233	552	8.3	0.1	8.4
2.H Other	168	258	90	53.3	-0.1	53.2
3 Agriculture	**357 738**	**362 440**	**4 701**	**1.3**	**-0.7**	**0.6**
3.A Enteric fermentation	176 688	176 990	302	0.2	0.2	0.3
3.B Manure management	61 236	60 680	-557	-0.9	0.2	-0.7
3.C Rice cultivation	2 337	2 405	68	2.9	-3.4	-0.5
3.D Agricultural soils	105 550	109 964	4 414	4.2	-2.5	1.6
3.F Field burning of agricultural residues	863	931	68	7.9	-2.9	4.9
3.G Liming	5689	5 659	-30	-0.5	-0.8	-1.3
3.H Urea application	3134	3 458	324	10.3	0.6	10.9
3.I Other carbon-containing fertilizers	619	626	8	1.3	-0.4	0.8
3.J Other	1623	1 728	105	6.5	-6.1	0.4
5 Waste	**103467**	**102 145**	**-1 322**	**-1.3**	**1.3**	**0.0**
5.A Solid waste disposal	70922	70 353	-569	-0.8	0.8	0.0
5.B Biological treatment of solid waste	6669	6 462	-208	-3.1	0.7	-2.5
5.C Incineration & open burning of waste	3579	3 697	118	3.3	3.9	7.2
5.D Waste water treatment & discharge	22244	21 577	-667	-3.0	2.6	-0.3
5.E Other	52	56	4	7.7	-9.1	-1.4

In the Energy sector, deviations after recalculation are very small. For Energy sector overall deviations after recalculation is +0.1 %.

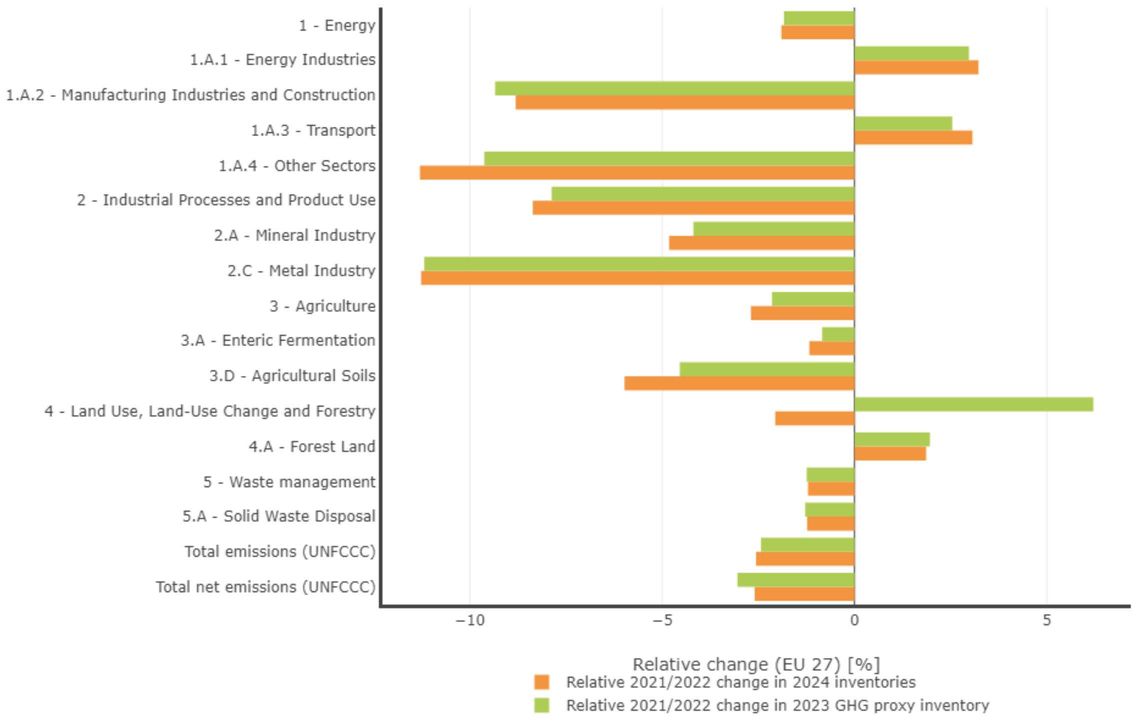
In IPPU, there were considerable recalculations for some categories. The largest relative deviations occurred in 2.H Other (+53.2 %), followed by category 2.D Non-energy Products from Fuels and Solvent Use (+15.1 %). The largest absolute difference was in 2.F Product Uses as Substitutes for ODS (+5.4 Mt CO_2 eq.). For the IPPU sector overall after allowing for recalculations the deviation is +0.5 %.

In the Agricultural sector, deviation before allowing for recalculation is +1.3 % and deviation after allowing for recalculations is +0.6 %. This can indicate that most of the recalculations were already considered when approximated inventories were created. The largest absolute deviations were in 3.D Agricultural soils (+4.4 Mt CO_2 eq. resp. +4.2 %). After considering recalculation effects the deviation for 3.D deviation decreases to +1.6 %.

After taking the recalculations effect into consideration, the deviation for the Waste sector indicates, that emissions in the Waste sector were overestimated only by less than 0.0 %. The largest deviation was found in subsector 5.D Wastewater treatment & discharge (-0.7 Mt CO_2 eq. or -3.0 %). After considering recalculations the deviation of 5.D emissions decreased significantly (-0.3 %).

By comparing the percentage changes in emission levels 2021/2022 as derived from the 2023 proxy GHG inventory on the one hand and from the 2024 official GHG inventory submissions to UNFCCC on the other by sectors, the differences are visible the most for LULUCF, see Figure 3-2.

Figure 3-2 Relative difference between proxy and submitted inventories by sector 2021/2022



Source: Member States submissions to the EU and proxy estimates for 2022.

Note: Only sectors with GHG emissions of more than 70 Mt CO_2 eq. in 2022 are shown.

4 Methodologies and data sources at Member State level

4.1 Description of different approaches

This report presents the estimated GHG emissions for 2023 based on Member State emissions estimates, submitted to EEA by 31 July. The aggregated EU proxy GHG emission estimates are based on these submissions and gap filling where necessary.

Under the Regulation (EU) 2018/1999, which replaces Regulation (EU) 525/2013 on the mechanism for monitoring and reporting GHG emissions (EU MMR) and its implementing provisions, Member States submit, where possible, to the European Commission approximated GHG inventories by 31 July every year for the preceding year t–1. Where a Member State has not submitted a 'proxy' inventory, the EEA uses its own estimates for gap-filling purposes in order to have a complete approximated GHG inventory at EU level.

In previous years the EEA and its ETC CM developed and used the latest activity data available at country level to estimate the emissions. For emission sources for which no appropriate data sets exist, emissions from the previous year are kept constant where historic data do not show a clear linear trend. That methodology which estimated emissions using a 'bottom-up' approach was complex and time-consuming. This year, submission of approximated greenhouse gas inventory was missing from Bulgaria and Hungary, which have a share less than 4 % of the emissions of the whole EU. Previous year gap-filling for Bulgaria had -2.9% deviation between the 2022 proxy and final GHG inventory of Bulgaria.

In some cases it has been necessary to allocate or distribute the reported emissions to sectors or within sub-sectors. This is done to allow for the aggregation and explanation of trends at EU level. Details are given in section 4.4.

4.2 MS proxies submitted

Member States are responsible for the methodological choice regarding their own estimates. The MS should submit approximated GHG inventories for the preceding year (*t*–1) in accordance with the table in Annex VI of Regulation (EU) 2020/1208 which is based on Summary2 table of the Common Reporting Format (CRF). The implementing regulation of the EU Governance Regulation requires the calculation at a level of disaggregation of source categories reflecting the activity data and methods available for the preparation of the proxy estimates. Therefore, it is in line with the legislation if Member States submit only partially complete aggregated table with their proxy estimates. Additionally, Member States should split emissions – where available – into ETS and non-ETS emissions and shall provide information on drivers and trends for *t*–1.

4.3 Gap-filling for MS not submitting a proxy inventory

This year estimates by the EEA and ETC CM are made for all source categories. Relevant data sources with updated activity or emissions data for the year *t*-1 were identified and used to calculate emissions. For source categories for which no international data sets with updated activity data exist or which are too complex for a simple approach, emissions from the previous year were kept constant. On this basis, a simple approach was developed covering the full scope of emissions included in a GHG inventory submission.

The EEA estimates are based on publicly available data sets at the European level. For the estimation of approximated emissions, the following data sources for emissions or activities were used:

- Verified emissions reported under the EU-ETS and recorded in the EUTL (EEA);
- Eurostat data on Supply, transformation and consumption

Based on these data sources, emission estimates for year 2023 were made for the following source categories:

- 1. Energy
  - 1.A Fuel Combustion
    - 1.A.1 Energy Industries
    - 1.A.2 Manufacturing Industries and Construction
    - 1.A.3 Transport
- 2. Industrial Processes and Product Use
  - 2.A Mineral Industry
  - 2.B Chemical Industry
  - 2.C Metal Production

All other source categories were filled by using previous year emissions.

The timing of these calculations depends on the release of the underlying data sources. The availability of data sources (including the MS GHG inventories) is shown in Table 4-1.

Table 4-1 Time of availability of data used for the proxy inventory

Data source	Availability
EUTL verified emissions	Data as of 5 August 2024 was used
Eurostat	Data as of 1 August was used for RES and 15 April 2024 for PEC.
GHG inventory data from CRF files	mid-April
Eurocontrol flight and emissions data	4 September

Source: ETC CM

National GHG inventories are required to fulfil certain principles as laid out in the UNFCCC reporting guidelines for GHG inventories: inventories must be transparent, consistent, comparable, complete and accurate (TCCCA). The IPCC Good Practice Guidance recommends Parties to perform QA/QC procedures that are important information to enable continuous improvement to inventory estimates. Through the quantification of uncertainty at the source level and for the inventory as a whole, improvements can be prioritised. Thus Parties may change methodologies in order to improve their greenhouse gas estimates at source level (e.g. moving from Tier 2 to Tier 3). Such methodological changes at Member States level cannot be captured in the calculation of the approximated GHG inventory for the EU. On-going quality improvements in Member States' inventories to take effect in next year's official submissions to UNFCCC are therefore a source of uncertainty for the proxy inventory.

It has to be taken into account that any recent national improvements of GHG reporting methodologies could not be considered for approximated GHG inventories calculated centrally by EEA and its ETC CM, as the 2024 estimates for the 2023 proxy inventory were based on the national methodologies used for 2024 inventory submissions (covering emissions until 2022). Thus, revised methodologies and parameters at Member States level can result in differences between the final inventory and the proxy inventory.

4.3.1 Energy and IPPU emissions from selected categories

To estimate CO_2, CH_4 or N_2O emissions from 1.A.1 Energy industries, 2.A Mineral industry and 2.C Metal industry, the following calculation was performed.

$$E_{\mathrm{GHG}}^{Y-1} = \frac{E_{ETS,Activities}^{Y-1}}{E_{ETS,Activities}^{Y-2}} \cdot E_{GHG}^{Y-2}$$

E_{GHG}^{Y-1}	Emission of CO_2, CH_4 or N_2O in source category in the proxy year
$E_{ETS,Activities}^{Y-1}$	ETS emissions for some activities in the proxy year
$E_{ETS,Activities}^{Y-2}$	ETS emissions for some activities in the previous year
E_{GHG}^{Y-2}	Emission of CO_2, CH_4 or N_2O in source category in the previous year

ETS emission data from the European Transaction Log (EUTL) was used. The following table shows the ETS activities that were aggregated for the calculation.

Table 4-2 ETS activities used for the emission estimates

Energy industries	20-99 All stationary installations
Mineral industry	29 Production of cement clinker
	30 Production of lime, or calcination of dolomite/magnesite
	31 Manufacture of glass
	32 Manufacture of ceramics
	33 Manufacture of mineral wool
Chemical industry	38 Production of nitric acid
	41 Production of ammonia
Metal industry	24 Production of pig iron or steel
	25 Production or processing of ferrous metals
	28 Production or processing of non-ferrous metals

To estimate CO_2, CH_4 or N_2O emissions from 1.A.2 Manufacturing industries and construction and 1.A.3 Transport, the following calculation was performed.

$$E_{\mathrm{GHG}}^{Y-1} = \frac{E_{ESTAT,fuel\ consumption}^{Y-1}}{E_{ESTAT,fuel\ consumption}^{Y-2}} \cdot E_{GHG}^{Y-2}$$

E_{GHG}^{Y-1}	Emission of CO_2, CH_4 or N_2O in source category in the proxy year
$E_{ESTAT,fuel\ consumption}^{Y-1}$	Consumption of selected fuel in the proxy year
$E_{ESTAT,fuel\ consumption}^{Y-2}$	Consumption of selected fuel in the previous year
E_{GHG}^{Y-2}	Emission of CO_2, CH_4 or N_2O in source category in the previous year

The following table shows a description of Eurostat data used for the calculation.

Table 4-3 Eurostat data used for the emission estimates

Manufacturing industries and construction	Inland consumption – calculated: Natural Gas
Transport	Gross inland deliveries – calculated: Gas oil and diesel oil (excluding biofuel portion)

4.3.2 Other emissions

For the source categories not mentioned before the emission values from previous year (2022) were used as proxy estimates for the year 2023. Also for all emissions of fluorinated greenhouse gases (HFCs, PFCs, SF_6, NF_3) previous year values were used as proxy estimates.

4.4 Methodology for gap-filling of partially complete proxy submissions

The approximated GHG emissions data are submitted by Member States in a form consistent with CRF Summary2 tables. However, these tables are not always submitted with complete sub-sector level disaggregation. Because EU emissions are the sum of the Member States' emissions, in order to achieve a complete EU proxy inventory, some gap filling has been required. For some MS proxies the reported emissions have been allocated or distributed within sub-sectors. This is done to allow for the aggregation and explanation of trends at EU level. Allocations were needed for Germany and Sweden.

4.4.1 *Total CO_2 eq., including indirect CO_2, without LULUCF in ETS and non-ETS*

Most Member States did report *Total CO_2 equivalent emissions, without LULUCF*. There has however been some ambiguity about how to report included indirect CO_2 emissions. In previous years, a total was included in cell J68 whether or not the total included indirect CO_2 emissions. Many MS leave this cell blank even if they do report indirect CO_2 emissions. For consistency this calculation has been adjusted (J68 =SUM J66, B65), in all proxy sheets so that there is a total shown in cell J68 whether or not the MS has calculated any indirect CO_2 emissions.

Most Member States provided a split of ETS and non-ETS emissions in their submissions.

4.4.2 *F-gases*

Emissions from fluorinated greenhouse gases (F-gases[7]) can appear in the following source categories of industrial processes and product use:

- 2.B Chemical industry
- 2.C Metal industry
- 2.E Electronic industry
- 2.F Product uses as ODS substitutes
- 2.G Other product manufacture and use
- 2.H Other

Germany reported F-gas emissions but did not disaggregate into source categories. Reported F-gas emissions were allocated using the shares of F-gas emissions per source categories of the latest available GHG inventories.

The gap-filling approach used for Bulgaria and Hungary (described in section 4.3), calculates proxy estimates for whole of the IPPU sector. For Bulgaria, the F-gas emissions were distributed in the same way as for Germany and Sweden using allocations derived from reports for the previous year.

4.4.3 *Gap-filling LULUCF*

Previous years values were applied to gap-fill LULUCF. Gap-filling was done only for Croatia.

4.4.4 *Gap-filling aviation data*

Gap-filling of aviation data was done by applying Eurocontrol data. International aviation was gap-filled for Bulgaria, Denmark, Luxembourg and Portugal. Domestic aviation was gap-filled for all Member States except Estonia, Finland, Malta and Poland. Eurocontrol aviation data is divided into three parts; international aviation, domestic aviation and to other aviation, when Eurocontrol has been uncertain where to allocate the data. Domestic aviation data has an effect on total ESR value.

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7 F-gas emissions include emission of the following gases or groups of gases: hydrofluorocarbons = HFCs; perfluorocarbons = PFCs; sulphur hexafluoride = SF_6; nitrogen triflouride =NF_3.

4.4.5 Gap-filling navigation data

Gap-filling of international navigation data was done by applying Eurostat monthly data about supply and transformation of oil and petroleum products (Eurostat 2024). This database contains information about international maritime bunkers. International navigation was gap-filled for Bulgaria, Denmark and Portugal.

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Annex 1: Detailed results for each Member State

Country	Compiled by	Submission date	Resubmission date
Austria	Member State	30 July 2024	
Belgium	Member State	18 July 2024	
Bulgaria	EEA, ETC CM		
Cyprus	Member State	05 July 2024	
Czechia	Member State	30 July 2024	
Germany	Member State	23 July 2024	
Denmark	Member State	29 July 2024	
Estonia	Member State	30 July 2024	
Spain	Member State	31 July 2024	
Finland	Member State	11 July 2024	
France	Member State	23 July 2024	
Greece	Member State	29 July 2024	
Croatia	Member State	29 July 2024	
Hungary	Member State	26 August 2024	
Ireland	Member State	31 July 2024	
Italy	Member State	26 July 2024	
Lithuania	Member State	31 July 2024	
Luxembourg	Member State	31 July 2024	
Latvia	Member State	15 July 2024	
Malta	Member State	29 July 2024	
Netherlands	Member State	24 July 2024	
Poland	Member State	05 July 2024	
Portugal	Member State	19 July 2024	
Romania	Member State	18 July 2024	
Sweden	Member State	18 July 2024	
Slovenia	Member State	30 July 2024	
Slovakia	Member State	08 July 2024	
European Union (EU27)	**EEA, ETC CM**		
Iceland	Country	11 July 2024	
Switzerland	Country	18 July 2024	
Norway	Country	05 July 2024	

All the above submissions are available in PDF format under this link: Reportnet 3 (europa.eu)

Annex 2: Bulgaria (EEA calculated)

Implementing Regulation Article 7: Reporting on approximated Greenhouse Gas Inventories

Member States shall report their approximated greenhouse gas inventories pursuant to Article 26(2) of Regulation (EU) 2018/1999

Year 2024
Submission 2023
Country BULGARIA
Geographical scope[4]

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Unspecified mix of HFCs and PFCs	NF_3	Total	ETS	non-ETS
	CO_2 equivalent (kt)									CO2 equivalent (Gg)	
Total (net emissions)[1]	23922.96	4399.07	527.34	701.85	0.01	23.96	NO, NA	NO, NA	35518.42		
1. Energy	30037.83	1699.18	262.49						31999.50		
A. Fuel combustion (sectoral approach)	29257.04	352.20	261.65						29870.89		
1. Energy industries	13726.35	14.31	61.53						13802.20		
2. Manufacturing industries and construction	4025.24	16.36	30.41						4072.01		
3. Transport (3)	10237.84	21.80	91.77						10351.41		
4. Other sectors	1228.43	299.71	77.65						1605.79		
5. Other	39.18	0.01	0.29						39.48		
B. Fugitive emissions from fuels	780.79	1346.98	0.84						2128.61		
1. Solid fuels	28.75	1045.52	0.00						1074.27		
2. Oil and natural gas	752.03	301.47	0.84						1054.33		
C. CO_2 transport and storage	0.00								0.00		
2. Industrial processes and product use	3538.00	0.00	60.50	701.85	0.01	23.96	NO, NA	NO, NA	4324.31		
A. Mineral industry	2583.66								2583.66		
B. Chemical industry	769.53	0.00	48.23	0.00	0.00	0.00	0.00	0.00	817.76		
C. Metal industry	146.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	146.64		
D. Non-energy products from fuels and solvent use	15.98	0.00	0.00						15.98		
E. Electronic Industry				0.00	0.00	0.00	0.00	0.00	0.00		
F. Product uses as ODS substitutes				701.85	0.01	0.00	0.00	0.00	701.86		
G. Other product manufacture and use	22.18	0.00	12.26	0.00	0.00	23.96	0.00	0.00	58.41		
H. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3. Agriculture	0.00	0.00	0.00						5943.22		
A. Enteric fermentation		1669.90							1669.90		
B. Manure management		363.20	258.19						621.39		
C. Rice cultivation		106.69							106.69		
D. Agricultural soils		0.00	3428.47						3428.47		
E. Prescribed burning of savannas		0.00	0.00						0.00		
F. Field burning of agricultural residues		30.43	6.49						36.92		
G. Liming	24.40								24.40		
H. Urea application	55.45								55.45		
I. Other carbon-containing fertilizers	0.00								0.00		
J. Other	0.00	0.00	0.00						0.00		
4. Land use, land-use change and forestry[1]	-9664.72	21.17	86.53						-9557.01		
A. Forest land	-8379.71	21.17	13.10						-8345.43		
B. Cropland	300.72	0.00	45.06						345.78		
C. Grassland	-849.53	0.00	12.02						-837.52		
D. Wetlands	72.25	0.00	7.13						79.38		
E. Settlements	161.80	0.00	9.22						171.03		
F. Other land	0.00	0.00	0.00						0.00		
G. Harvested wood products	-970.25	0.00							-970.25		
H. Other	0.00	0.00	0.00						0.00		
5. Waste	11.86	2678.71	117.83						2808.40		
A. Solid waste disposal	0.00	2162.31							2162.31		
B. Biological treatment of solid waste		8.51	4.74						13.25		
C. Incineration and open burning of waste	11.86	0.00	0.25						12.11		
D. Waste water treatment and discharge		507.89	112.84						620.73		
E. Other	0.00	0.00	0.00						NO		
6. Other *(as specified in summary 1.A)*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO		

Memo items:											
International bunkers	805.27	0.69	6.69						812.64		
Aviation	593.96	0.18	5.20						599.33		
Navigation	211.31	0.51	1.49						213.31		
CO_2 emissions from biomass											
CO_2 captured											
Indirect CO_2 [2]	NO										
Total CO_2 equivalent emissions without land use, land-use change and forestry									45075.43	21635.39	23440.05
Total CO_2 equivalent emissions with land use, land-use change and forestry									35518.42		
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry									45075.43		
indirect CO_2, with land use, land-use change and forestry									35518.42		

(1) For carbon dioxide (CO_2) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always

(2) For Member States that report indirect CO2 the national totals shall be provided with and without indirect CO2.

(3) CO2 emissions from civil aviation are treated as zero for effort sharing purposes.

(4) Where applicable: please clarify the geographical scope

Brief description of the key drivers underpinning the increase or decrease in GHG emissions in x-1 (proxy) compared to x-2 (inventory). If this information is publicly available please include the hyperlink to the relevant website. Information on the uncertainties associated with the estimations for the LULUCF sector may also be provided.
The trend of 1.A fuel combustion widely follows the trend in preliminary energy statistics (https://www.statistik.at/statistiken/energie-und-umwelt/energie/energiebilanzen) The most significant trends 2021-2022 in fuel consumption by type of fuel are: Transport diesel sales decreased by -5.8% and gasoline sales increased by +3.3% (approx. -0.9 Mt of CO2 from diesel and gasoline). Gasoil consumption decreased by -16% (approx. -0.6 Mt of CO2) Natural gas consumption decreased by 11% (approx.-2.0 Mt of CO2) (http://www.e-control.at/de/statistik/gas) Refinery emissions decreased by -0.5 Mt CO2 (-18%) due to about 30% lower crude oil processing Industrial processes: CO2 emissions from iron and steel industries (1.A.2.a and 2.C.1) decreased by -6% (approx -0.7 Mt CO2) due to an decrease in crude steel production (-5%). CO2 emissions from Non Metallic Mineral Products (2.A.1) decreased by approx. -0.1 Mt CO2. CO2 emissions from Chemicals Industries (2.B) decreased by approx. -0.1 Mt CO2. (https://www.worldsteel.org/steel-by-topic/statistics.html) International bunkers: Kerosin consumption increased by +52% (+0.6 Mt CO2) Agriculture: Fertilizer Use: two-year mean value decreased by 8.7% (https://www.ama.at/Marktinformationen/Getreide-und-Olsaaten/Dungemittel) Animals numbers: total cattle decreased by 0.5%; milk cows increased by 4.6 % while milk yield increased by 0.01%; swine number decreased by 4.9% (https://www.ama.at/Marktinformationen/Vieh-und-Fleisch/Produktion; https://www.statistik.at/statistiken/land-und-forstwirtschaft/tiere-tierische-erzeugung/viehbestand/viehbestand-jaehrlich)

List of abbreviations

AR5	IPCC Fifth Assessment Report: Climate Change 2014
BP	British Petroleum
CH_4	Methane
CO_2	Carbon dioxide
CO_2 eq.	Carbon dioxide equivalent
CRF	Common reporting format
EC	European Commission
EEA	European Environment Agency The EEA has 32 member countries: the 27 European Union Member States together with Iceland, Liechtenstein, Norway, Switzerland and Turkey
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETC CM	European Topic Centre for Climate Change Mitigation
ETS	Emissions Trading System
EU	European Union
EU27	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden
EUTL	European Union Transaction Log
F-gas	Fluorinated greenhouse gas; umbrella term including HFC, PFC, SF_6 and NF_3
GDP	Gross domestic product
GHG	Greenhouse gas
GWP	Global warming potential
HDD	Heating degree days
HFCs	Hydrofluorocarbons
IEA	International Energy Agency
IEF	Implied emission factor
kt	Kilotons (thousand tons)
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
LULUCF	Land use, land-use change and forestry
MMR	Monitoring Mechanism Regulation (Regulation (EU) 525/2013)
Mt	Megatons (million tons)
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
ODS	Ozone-depleting substance
PEC	Primary Energy Consumption
PFCs	Perfluorocarbons
QA/QC	Quality assurance and quality control
QELRC	Quantified emission limitation and reduction commitment
SF_6	Sulphur Hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change

Abbreviations of member states and EEA countries included in this report

AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
EL	Greece
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
IS	Iceland
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom
CH	Switzerland
NO	Norway
IS	Iceland

European Topic Centre on
Climate change mitigation

https://www.eionet.europa.eu/etcs/etc-cm

The European Topic Centre on Climate change mitigation (ETC-CM) is a consortium of European institutes under contract of the European Environment Agency.

European Environment Agency
European Topic Centre
Climate change mitigation