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Annual European Union greenhouse gas inventory 1990–2023 and inventory document 2025

GHG inventory submission under the Convention

European Environment Agency

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Annex I: Key category analysis

Annex II: Assessment of uncertainty (the assessment is included in NID, section 1.6)

Annex III: Summary description of the methodologies used by each Member State for the EU Key Categories

ES-1 BACKGROUND INFORMATION ON GREENHOUSE GAS INVENTORIES AND CLIMATE CHANGE

This report is the official inventory submission of the European Union (EU) for 2025 under the United Nations Framework Convention on Climate Change (UNFCCC) and follows the modalities, procedures and guidelines (MPGs) under the Enhanced Transparency Framework (ETF) of the Paris Agreement (Decisions 18/CMA.1 and 5/CMA.3).

The EU, as a party to the Paris Agreement and to the UNFCCC, reports annually on greenhouse gas (GHG) inventories of anthropogenic emissions and removals within the area covered by its Member States (i.e. emissions taking place within the EU territory). The report covers period from 1990 to the current calendar year (t) minus two (t−2). Thus this report describes years between 1990 and 2023.

The legal basis for the compilation of the EU inventory is the Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action (Governance Regulation)[1], the Commission Implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014[2], and the Commission Delegated Regulation (EU) 2020/1044 of 8 May 2020 supplementing Regulation (EU) 2018/1999 of the European Parliament and of the Council with regard to values for global warming potentials and the inventory guidelines and with regard to the Union inventory system and repealing Commission Delegated Regulation (EU) No 666/2014.

These regulations establish a mechanism for:

a) ensuring the timeliness, transparency, accuracy, consistency, comparability and completeness of reporting by the EU and its Member States to the UNFCCC Secretariat;
b) reporting and verifying information relating to commitments of the EU and its Member States pursuant to the UNFCCC and the Paris Agreement and evaluating progress towards meeting those commitments;
c) monitoring and reporting all anthropogenic emissions by sources, and removals by sinks, of GHGs not controlled by the Montreal Protocol on substances that deplete the ozone layer in Member States;
d) monitoring, reporting, reviewing and verifying GHG emissions and other information under the Effort Sharing Regulation[3].

The EU GHG inventory results from the compilation of the direct sum of emissions and removals from the national inventories of the EU Member States. Energy data from Eurostat are used for the reference approach for CO_2 emissions from fossil fuels, developed by the Intergovernmental Panel on Climate Change (IPCC).

The main institutions involved in the compilation of the EU GHG inventory are the Member States, the European Commission Directorate-General for Climate Action (DG CLIMA), the European Environment Agency (EEA) and its European Topic Centre on Climate Change Mitigation (ETC/CM), and Eurostat.

The annual process of compiling the EU GHG inventory is described below:

[1] OJ L 328, 21.12.2018, p. 1–77 .

[2] OJ L 278, 26.8.2020, pp. 1–132

[3] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (OJ L 156, 19.6.2018, p. 26–42.

1. Member States submit their annual GHG inventories by 15 January each year to the European Commission (DG CLIMA), with a copy to the EEA.
2. The EEA and its ETC/CM then perform 'initial checks' on the data submitted. Specific findings from the initial quality assurance/quality control (QA/QC) checks are communicated to Member States by 28 February. In addition, the draft EU GHG inventory and inventory report are circulated to Member States for review and comments by 28 February.
3. Member States check their national data and the information presented in the EU GHG inventory report, respond to specific findings from the initial QA/QC checks by the EU inventory team, which may lead to improved emissions and removals by Member States, send updates if necessary and review the EU inventory report by 15 March.
4. The EEA and its ETC/CM review final inventory submissions from Member States and their responses to the initial checks and prepare the final EU GHG inventory and inventory report by 15 April so that they can be submitted to the UNFCCC[4].

ES-2 SUMMARY OF TRENDS RELATED TO EMISSIONS AND REMOVALS IN THE EU

Total GHG emissions - including Land Use, Land Use Change and Forestry (LULUCF) and indirect CO_2 emissions[5] - in the EU amounted to 2 908 million tonnes CO_2 equivalent in 2023. All GHG emission totals provided in this report include indirect CO_2 emissions[6].

[4] The EU, as Party to the Paris Agreement and the UNFCCC, reports its GHG inventory according to the modalities, procedures and guidelines (MPGs) under the Enhanced Transparency Framework (ETF) of the Paris Agreement (Decisions 18/CMA.1 and 5/CMA.3).

Due to remaining technical shortcomings in the UNFCCC ETF tools, there have been substantial difficulties in preparing and finalizing the complete EU GHG inventory tables, which are based on the aggregation of emissions and removals from Member States' GHG inventories.

The EU CRT tables submitted as part of its 15 April 2025 inventory under the Convention are based on the aggregation of standard variables reported in the inventories of its Member States. Country-specific variables cannot be imported due to outstanding issues with the ETF tool. In addition to the submission under the Convention due 15 April 2025, the EU will subsequently report the CRT tables corresponding to the 2024 inventory submission under the Paris Agreement.

It is important to highlight that no emissions or removals are missing from the CRT tables, but that the level of disaggregation has been affected. The EU has all the information reported by Member States from the GHG inventories submitted to the EU, which have been used for the production of the EU's NID. All emissions and removals are also available from the GHG data viewers and databases published on the EEA website.

There are regular discussions between the EEA and the UNFCCC secretariat's technical support aiming to resolve the issues with the EU aggregation as quickly as possible. The complete CRT tables will be submitted as soon as the EU aggregation, including all standard and country-specific variables, checks out and is fully consistent with the sum of emissions and removals from Member States' inventories.

In addition, because of the ongoing improvements and several releases of the ETF tools by the UNFCCC secretariat, reported data may differ from actual inventory data in some cases. When known, outstanding issues affecting the aggregation of emissions and removals as well as any errors linked to the use of confidential data, will be mentioned in the different sectoral chapters.

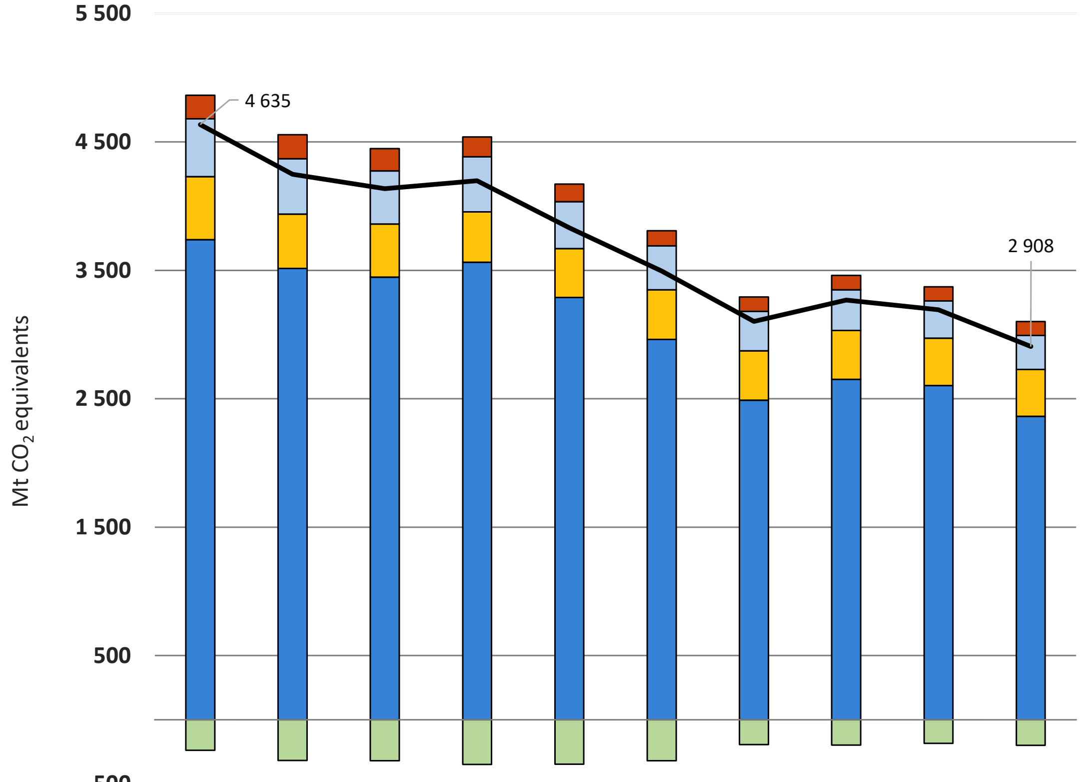
Thus, the EU should not be held responsible for technical issues and errors caused by the CRT electronic tool affecting the quality of the GHG inventory during the technical expert review. The EU expects that further development of the ETF tools should eventually eliminate the number of bugs and remaining errors.

[5] Unless otherwise specified, the national GHG totals in this report always include LULUCF and indirect CO_2 emissions. They may also be referred to as 'net' total GHG emissions. Besides LULUCF, the other UNFCCC sectors that are included in the national totals are energy, industrial processes and product use (IPPU), agriculture, waste.

[6] According to the MPGs, Parties may report indirect CO_2 from the atmospheric oxidation of CH_4, CO and NMVOCs. For Parties that decide to report indirect CO_2, the national totals will be presented with and without indirect CO_2. The EU national total includes indirect CO_2 emissions if Member States have reported these emissions. The CRT tables include national totals, including and excluding indirect CO_2 emissions.

In 2023, total GHG emissions were 37 % (1 728 million tonnes CO_2 equivalents) below 1990 levels. Emissions decreased by 8.9 % or 285 million tonnes CO_2 equivalents between 2022 and 2023 (Figure ES. 1).

Figure ES. 1   EU GHG emissions and removals (MT CO_2 eq)



	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
LULUCF	-237	-316	-318	-347	-346	-319	-194	-196	-183	-198
Waste	185	187	174	155	137	119	112	112	111	109
IPPU	450	430	414	429	364	342	307	318	290	265
Agriculture	490	424	413	392	381	386	384	380	368	365
Energy	3 740	3 515	3 447	3 565	3 290	2 962	2 490	2 651	2 604	2 364
Total net GHG emissions (including indirect CO2)	4 635	4 248	4 137	4 199	3 831	3 495	3 103	3 269	3 193	2 908

Notes: CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC guidelines and are not included in national totals. In addition, no adjustments for temperature variations or electricity trade are considered. The 100-year global warming potentials are those from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

1.1 Main trends by source category, 1990-2023

Total GHG emissions (including LULUCF and indirect CO_2 emissions) decreased by 1 728 Mt CO_2 eq. since 1990 reaching 2 908 Mt CO_2 equivalent in 2023. These emissions exclude international aviation and international navigation.

There has been a progressive decoupling between gross domestic product (GDP) and emissions, with GDP increasing by 70% and greenhouse gas emissions falling by 37% between 1990 and 2023.

The trend in GHG emissions over the 33-year period was driven by a variety of factors, including the growing share in the use of renewables, the use of less carbon intensive fossil fuels and improvements in energy efficiency, as well as to structural changes in the economy.

The long-lasting changes have resulted in a lower energy intensity of the economy and in a lower carbon intensity of energy production and consumption in 2023 compared to 1990. Demand for energy to heat households has also been lower, as, besides better insulation standards in buildings, Europe on average has experienced milder winters since 1990, which has also helped reduce emissions.

GHG emissions decreased in the majority of sectors between 1990 and 2023, with the notable exception of transport, refrigeration and air conditioning, where emissions increased, and forest land, where net removals decreased and the negative trend accelerated in the past few years. The main reasons for the decrease in net removals include the aging of the forests from the late 2000s and a lower annual increment, as well as increased harvesting and the negative impacts from climate change. At the aggregate level, emission reductions were largest for public electricity and heat production, manufacturing industries and construction, residential combustion, and iron and steel production (including energy-related emissions).

A combination of factors can explain lower emissions in industrial sectors, such as improved efficiency and lower carbon intensity as well as structural changes in the economy, with a higher share of services and a lower share of more-energy-intensive industry in total GDP. For industry as a whole, including both combustion and processes, EU emissions decreased by 46% between 1990 and 2023.

Emissions from electricity and heat production also decreased strongly, by 53%, over the past 33 years since 1990. In addition to improved energy efficiency there has been a move towards less carbon intense fuels. Between 1990 and 2023, the use of solid and liquid fuels in thermal power stations decreased strongly (by 64 % and 85 %, respectively) whereas natural gas consumption developed in the opposite direction (increasing by 48 %). Coal consumption in 1990 was almost three times higher than in 2023. The use of renewable energy sources in electricity and heat generation has increased substantially in the EU since 1990. Improved energy efficiency and a less carbon intensive fuel mix have resulted in reduced CO_2 emissions per unit of fossil energy generated.

Emissions in the residential sector also represented one of the largest reductions. Energy efficiency improvements from better insulation standards in buildings, and a less carbon-intensive fuel mix, can partly explain lower demand for space heating in the EU over the past 33 years.

In terms of the main GHGs, CO_2 was responsible for the largest reduction in emissions since 1990. Reductions in emissions from N_2O and CH_4 have also been substantial, reflecting among other things lower levels of mining activities, lower agricultural livestock, as well as lower emissions from managed waste disposal on land and from reduced adipic and nitric acid production.

A number of policies, both EU and Member State specific, have contributed to the overall GHG emission reduction, such as key agricultural and environmental policies in the 1990s and climate and energy policies in the past two decades since 2005. The latter include the implementation of the EU Emissions Trading System as well as national policies for the sectors not covered by this system. More information on policies and measures can be found in the EU's first Biennial Transparency Report under the Enhanced Transparency Framework of the Paris Agreement.

Almost all EU Member States reduced emissions compared to 1990 and thus contributed to the overall positive EU performance (see Table ES. 3). Germany, Romania, Italy and France accounted for almost two thirds of the total net reduction in EU emissions during the past 33 years.

Table ES. 1 shows those categories that made the largest contribution to the change in total GHG emissions and removals in the EU between 1990 and 2023.

Table ES. 1 Overview of EU categories whose emissions and/or removals increased or decreased by more than 20 million tonnes CO_2 equivalent in the period 1990–2023

Source category	**Million tonnes (CO_2 equivalents)**
Road Transportation (CO_2 from 1.A.3.b)	139
Forest land remaining forest land (CO_2 from 4.A.1)	101
Refrigeration and Air conditioning (HFCs from 2.F.1)	51
Cropland remaining cropland (CO_2 from 4.B.1)	-20
Unmanaged Waste Disposal Sites (CH_4 from 5.A.2)	-22
Agricultural soils: Direct N_2O emissions (N_2O from 3.D.1)	-27
Grassland (CO_2 from 4.C)	-28
Adipic Acid Production (N_2O from 2.B.3)	-33
Cement Production (CO2 from 2.A.1)	-34
Managed Waste Disposal Sites (CH_4 from 5.A.1)	-37
Nitric Acid Production (N_2O from 2.B.2)	-39
Cropland (CO_2 from 4.B)	-39
Fugitive Emissions from Oil and Natural Gas (CH_4 from 1.B.2)	-46
Enteric Fermentation: Cattle (CH_4 from 3.A.1)	-51
Fugitive Emissions from Solid Fuels (CH_4 from 1.B.1)	-61
Fuels used Commercial/Institutional Sector (CO_2 from 1.A.4.a)	-69
Manufacture of Solid Fuels and Other Energy Industries (CO_2 from 1.A.1.c)	-73
Iron and Steel Production (CO_2 from 1.A.2.a + 2.C.1)	-133
Fuels used Residential Sector (CO_2 from 1.A.4.b)	-175
Manufacturing industries (excl. Iron and steel) (Energy-related CO_2 from 1.A.2 excl. 1.A.2.a)	-273
Public Electricity and Heat Production (CO_2 from 1.A.1.a)	-658
Total	**-1728**

Notes: As the table only presents sectors whose emissions have increased or decreased by at least 20 million tonnes CO_2 equivalent, the sum of the EU key categories in this table does not match the total change in emissions listed at the bottom of the table, which includes all emission sources in the EU inventory. Note that LULUCF categories and the indirect CO_2 emissions are reflected in this table.

1.2 Main trends by source category, 2022–2023

Total GHG emissions (including LULUCF) decreased in 2023 by 285 million tonnes, or 8.9 % compared to 2022, to reach 2 908 Mt CO_2 equivalent in 2023. The year 2023 performance represents the largest relative (%) reduction in GHG emissions in the EU since 1990, and the third largest in absolute terms – only after the 2009 financial crisis and the 2020 COVID-19 pandemic.

The largest decrease in emissions in 2023 occurred in the energy sector, and particularly in public electricity and heat production, where emissions decreased by 22% (corresponding to 161 Mt CO_2e). This represents the largest decrease in emissions from electricity and heat generation in the EU of the past 33 years of inventory data since 1990.

The reduction in emissions in the power sector took place in a context of lower total energy consumption in the EU in 2023 and was due to both a strong reduction in the consumption of coal and natural gas as well as a significant increase in renewable energy consumption.

According to Eurostat data, the use of renewable energy increased significantly in 2023, mostly due to hydro, wind and solar (bioenergy consumption decreased in 2023).

Table ES. 2 shows the categories making the largest contribution to the change in GHG emissions and removals in the EU between 2022 and 2023.

Table ES. 2 Overview of EU categories whose emissions and/or removals increased or decreased by more than 3 million tonnes CO_2 equivalent in the period 2022–2023

Source category	Million tonnes (CO_2 equivalents)
Harvested wood products (CO_2 from 4.G)	8
Fuels used Commercial/Institutional Sector (CO_2 from 1.A.4.a)	-5
Cement Production (CO_2 from 2.A.1)	-6
Road Transportation (CO_2 from 1.A.3.b)	-8
Iron and Steel Production (CO_2 from 1.A.2.a + 2.C.1)	-8
Forest land remaining forest land (CO_2 from 4.A.1)	-20
Fuels used Residential Sector (CO_2 from 1.A.4.b)	-25
Manufacturing industries (excl. Iron and steel) (Energy-related CO_2 from 1.A.2 excl. 1.A.2.a)	-26
Public Electricity and Heat Production (CO_2 from 1.A.1.a)	-161
Total	**-285**

Notes: As the table only presents sectors whose emissions have increased or decreased by at least 3 million tonnes of CO_2 equivalent, the sum of the EU key categories in this table does not match the total change in emissions listed at the bottom of the table, which includes all emission sources in the EU inventory. Note that LULUCF categories and the indirect CO_2 emissions are reflected in this table.

1.3 Overview of total GHG emissions by countries

Table ES.3 gives an overview of total GHG emissions by countries, illustrating where the main changes occurred.

Table ES. 3 GHG emissions in million tonnes CO_2 equivalent

	1990 (million tonnes)	2023 (million tonnes)	2022 - 2023 (million tonnes)	Change 2022 - 2023 (%)	Change 1990-2023 (%)	Share MS/EU 2023
Austria	65.9	76.2	2.9	4.0%	15.7%	2.6%
Belgium	142.8	97.9	-4.5	-4.4%	-31.4%	3.4%
Bulgaria	81.8	36.8	-12.5	-25.4%	-55.0%	1.3%
Croatia	25.2	19.9	0.2	1.2%	-21.1%	0.7%
Cyprus	5.4	8.2	0.1	1.9%	50.9%	0.3%
Czechia	186.7	98.9	-17.5	-15.1%	-47.0%	3.4%
Denmark	79.2	38.8	-3.6	-8.4%	-51.0%	1.3%
Estonia	35.3	13.0	-1.4	-9.4%	-63.2%	0.4%
Finland	49.4	53.1	-4.7	-8.1%	7.5%	1.8%
France	524.2	339.0	-30.5	-8.2%	-35.3%	11.7%
Germany	1288.4	740.7	-83.7	-10.2%	-42.5%	25.5%
Greece	101.7	67.8	-4.8	-6.6%	-33.3%	2.3%
Hungary	91.6	48.5	-4.5	-8.4%	-47.1%	1.7%
Ireland	60.8	58.8	-3.8	-6.0%	-3.3%	2.0%
Italy	519.1	331.2	-42.5	-11.4%	-36.2%	11.4%
Latvia	13.5	14.6	-1.2	-7.6%	7.9%	0.5%
Lithuania	43.2	12.6	0.0	0.2%	-70.7%	0.4%
Luxembourg	12.8	7.1	-0.4	-5.0%	-44.5%	0.2%
Malta	2.6	2.2	0.0	-0.6%	-14.1%	0.1%
Netherlands	227.5	146.4	-10.6	-6.7%	-35.6%	5.0%
Poland	442.9	315.8	-28.6	-8.3%	-28.7%	10.9%
Portugal	63.3	51.2	-4.8	-8.5%	-19.1%	1.8%
Romania	230.4	57.4	-6.5	-10.2%	-75.1%	2.0%
Slovakia	64.6	28.3	-1.3	-4.4%	-56.1%	1.0%
Slovenia	14.5	10.5	-0.8	-7.3%	-27.3%	0.4%
Spain	250.5	218.9	-22.7	-9.4%	-12.6%	7.5%
Sweden	11.9	13.2	2.6	24.3%	11.0%	0.5%
EU-27	4635	2908	-285.0	-8.9%	-37.3%	

Notes: Due to an error in the aggregation of the waste subcategories in the Cypriot inventory, the sum of all Member States for 2020-2023 does not add up to the EU-27 value. There is a difference of approximately 0.4 Mt CO_2 equivalent.

1.4 Summary of emissions and removals by main greenhouse gas

Table ES. 4 gives an overview of the main trends in EU GHG emissions and removals for 1990–2023. In the EU the most important GHG is CO_2, accounting for 78 % of total EU emissions in 2023 including LULUCF. In 2023, CO_2 emissions including LULUCF were 2 266 Mt, which was 37 % below 1990 levels. Emissions of CH_4 and N_2O also decreased substantially in the past 33 years since 1990. Emissions of HFCs increased compared to 1990 but have reported significant reductions in past years.

Table ES. 4 Overview of EU GHG emissions and removals from 1990 to 2023 in million tonnes CO_2 equivalent

GREENHOUSE GAS EMISSIONS	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
Net CO_2 emissions/removals	3 614	3 302	3 267	3 375	3 066	2 765	2 421	2 592	2 538	2 266
CO_2 emissions (without LULUCF)	3 881	3 648	3 613	3 748	3 438	3 108	2 639	2 814	2 747	2 493
CH_4	671	613	561	513	475	447	421	419	411	403
N_2O	300	277	246	234	196	190	188	188	177	176
HFCs	12.9	21.5	41.8	62.7	83.7	83.1	65.5	62.4	60.3	57.0
PFCs	21.8	15.1	10.5	6.3	3.2	2.8	1.8	1.6	1.4	1.0
Unspecified mix of HFCs and PFCs	5.1	5.3	2.2	1.2	0.6	0.7	1.5	1.5	1.1	0.2
SF_6	9.9	14.1	8.6	6.7	5.8	5.9	5.4	4.9	4.3	4.0
NF_3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total (with net CO_2 emissions/removals)	**4 635**	**4 248**	**4 137**	**4 199**	**3 831**	**3 495**	**3 103**	**3 269**	**3 193**	**2 908**
Total (without LULUCF)	**4 873**	**4 563**	**4 455**	**4 546**	**4 177**	**3 813**	**3 297**	**3 465**	**3 376**	**3 106**

Notes: CO_2 emissions include indirect CO_2. Please note that historical data may have changed compared to last year's Inventory Report due to recalculations

1.5 Summary of emissions and removals by main source and sink category

Figure ES. 1 and Table ES. 5 show EU GHG emissions for the main sectors for the period 1990–2023. The most important sector in terms of GHG emissions is energy (i.e. combustion and fugitive emissions), which accounted for 81 % of total EU net emissions in 2023. The second largest sector is agriculture (13 %), followed by industrial processes (9 %). The LULUCF sector accounted for - 7 % of the EU's net national total emissions in 2023. More detailed trend descriptions are included in the individual sector chapters (chapters 3-7).

Table ES. 5 Overview of EU GHG emissions (in million tonnes CO_2-equivalent) in the main source and sink categories for the period 1990 to 2023

GHG SOURCE AND SINK	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
1. Energy	3 740	3 515	3 447	3 565	3 290	2 962	2 490	2 651	2 604	2 364
2. Industrial Processes	450	430	414	429	364	342	307	318	290	265
3. Agriculture	490	424	413	392	381	386	384	380	368	365
4. Land-Use, Land-Use Change and Forestry	-237	-316	-318	-347	-346	-319	-194	-196	-183	-198
5. Waste	185	187	174	155	137	119	112	112	111	109
6. Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indirect CO_2 emissions	7.6	6.9	6.3	5.7	4.8	4.1	3.9	3.9	3.6	3.4
Total (with net CO_2 emissions/removals)	**4 635**	**4 248**	**4 137**	**4 199**	**3 831**	**3 495**	**3 103**	**3 269**	**3 193**	**2 908**
Total (without LULUCF)	**4 873**	**4 563**	**4 455**	**4 546**	**4 177**	**3 813**	**3 297**	**3 465**	**3 376**	**3 106**

1.6 Summary of EU Member State emission Trends

Table ES. 6 gives an overview of Member States' contributions to EU GHG emissions for the period 1990–2023. Countries show large variations in GHG emissions trends.

Table ES. 6 Overview of countries' contributions to total EU GHG emissions, including LULUCF, international aviation and including indirect CO_2, from 1990 to 2023 in million tonnes CO_2-equivalent

Member State	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
Austria	65.9	62.2	63.3	78.1	73.7	75.3	73.7	74.7	73.3	76.2
Belgium	142.8	151.1	146.7	143.1	132.8	117.8	106.6	109.4	102.5	97.9
Bulgaria	81.8	55.4	40.8	46.8	47.9	52.9	38.7	44.9	49.3	36.8
Croatia	25.2	14.3	19.1	22.0	21.4	19.1	18.2	18.7	19.7	19.9
Cyprus	5.4	6.8	8.2	9.0	9.2	8.0	7.8	7.9	8.0	8.2
Czechia	186.7	146.6	139.6	138.5	131.4	117.9	119.5	121.8	116.5	98.9
Denmark	79.2	85.9	78.2	73.8	68.0	50.5	44.7	44.5	42.4	38.8
Estonia	35.3	15.5	14.5	16.7	16.3	18.6	12.5	13.4	14.3	13.0
Finland	49.4	50.8	49.7	45.6	54.7	43.8	49.6	59.2	57.8	53.1
France	524.2	511.2	525.3	499.6	473.0	420.4	358.3	384.8	369.5	339.0
Germany	1288.4	1116.1	1047.0	1011.1	935.6	907.6	809.6	824.5	824.4	740.7
Greece	101.7	106.5	124.1	133.2	115.8	92.6	70.7	73.0	72.6	67.8
Hungary	91.6	71.3	74.3	71.4	62.2	56.7	55.9	56.8	53.0	48.5
Ireland	60.8	65.9	74.8	76.4	66.9	64.4	62.3	64.5	62.6	58.8
Italy	519.1	513.6	541.6	562.4	483.2	401.6	340.2	374.1	373.7	331.2
Latvia	13.5	-2.3	-1.8	4.4	9.8	11.0	11.0	12.7	15.8	14.6
Lithuania	43.2	17.6	9.1	17.1	9.6	12.2	14.4	14.3	12.6	12.6
Luxembourg	12.8	9.6	9.1	12.5	12.0	9.9	8.5	8.7	7.5	7.1
Malta	2.6	2.7	2.7	3.0	3.0	2.1	2.1	2.1	2.3	2.2
Netherlands	227.5	236.5	224.6	220.1	219.4	199.9	168.3	170.6	157.0	146.4
Poland	442.9	423.9	354.2	347.6	367.9	348.1	347.2	374.4	344.4	315.8
Portugal	63.3	64.1	83.7	90.5	65.8	65.0	54.0	53.5	56.0	51.2
Romania	230.4	160.1	111.7	119.4	89.8	68.4	62.4	67.6	64.0	57.4
Slovakia	64.6	43.6	39.4	46.1	40.8	35.2	29.8	33.7	29.7	28.3
Slovenia	14.5	13.8	12.6	13.4	12.6	17.4	11.6	11.7	11.3	10.5
Spain	250.5	287.0	337.3	389.2	306.1	280.3	218.7	235.8	241.7	218.9
Sweden	11.9	17.9	7.1	8.0	2.3	-2.0	6.6	11.1	10.6	13.2
EU-27	**4635**	**4248**	**4137**	**4199**	**3831**	**3495**	**3103**	**3269**	**3193**	**2908**

Notes: Due to an error in the aggregation of the waste subcategories in the Cypriot inventory, the sum of all Member States for 2020-2023 does not add up to the EU-27 value. There is a difference of approximately 0.4 Mt CO_2 equivalent.

The largest emitters in the EU inventory in 2023 were Germany (25 % of EU net emissions), followed by France, Italy and Poland. The majority of EU Member States contributed to the strong decrease in GHG emissions in the EU between 1990 and 2023, with Germany, Italy, France and Romania together accounting for 63 % of the total net reduction.

Common drivers to lower GHG emissions in most EU countries over the past 33 years have been the use of less carbon intensive fuels, with a switch from coal to gas and a strong increase in the use of renewable energy sources, as well as significant improvements in energy efficiency, both in transformation and end use.

More information on GHG emission trends by Member State can be found in the relevant national inventory reports to UNFCCC https://unfccc.int/ghg-inventories-annex-i-parties/2025.

ES-3 OTHER INFORMATION

INTERNATIONAL AVIATION AND MARITIME TRANSPORTATION

After a sharp drop due to the COVID-19 pandemic, emissions from international aviation were almost at 1990 levels in 2020. However, after 2020 emissions increased rapidly and were 125 % above the 1990 level in 2023; between 2022 and 2023 alone, emissions increased by 11 %. In contrast, GHG emissions from international shipping decreased in 2023 compared to 2022 by 7 % due to the economic downturn and were 21 % above 1990 levels in 2023. In 2023, international aviation accounted for 123 million tonnes CO_2 equivalent and international shipping for 122 million tonnes CO_2 equivalent.

INDIRECT GREENHOUSE GAS EMISSIONS

The CO_2 resulting from the atmospheric oxidation of CH_4, CO and NMVOC is referred to as indirect CO_2. These indirect CO_2 emissions are included in the general methodological approach which assumes that all the carbon in the fuel (minus the portion that remains as soot or ash) is oxidized to CO_2 whereas a fraction of this carbon is initially emitted as CH_4, CO or NMVOC.

In addition, indirect CO_2 emissions from solvent use, road paving with asphalt and asphalt roofing are generally reported under CRT category 2D3 ,'non-energy products from fuels and solvent use according to UNFCCC Reporting Guidelines. For other sources of indirect CO_2, emissions are reported in CRT Table 6. Latter amount to 3.4 Mt in the EU in 2023; these emissions are included in the national total GHG emissions as visible in Table ES.5 above.

Indirect N_2O emissions in the agriculture sector address nitrous oxide (N_2O) emissions that result from the deposition of the nitrogen emitted as nitrogen oxides (NO_X) and ammonia (NH_3). In addition to agriculture, the 2006 IPCC Guidelines include guidance for estimating N_2O emissions resulting from nitrogen deposition of all anthropogenic sources of NO_X and NH_3 (in particular from sources in the energy and IPPU sectors). The 2006 IPCC Guidelines, Volume 5, also address indirect N_2O emissions which occur from the release of wastewater effluents into waterways, lakes or the sea. The indirect N_2O emissions not included in the agriculture sector are reported in Table 6 of the EU CRT tables. These emissions were at 16 kt of CO_2 equivalent and are not included in the national total GHG emissions.

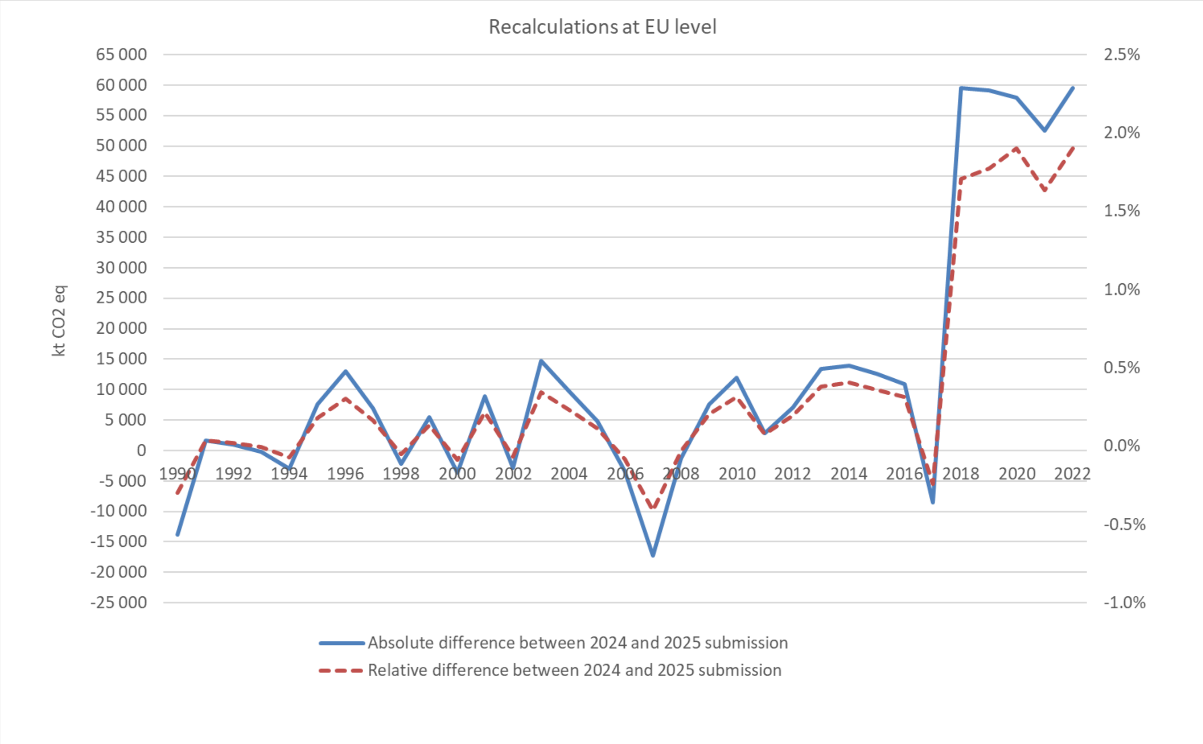
INFORMATION ON RECALCULATIONS

According to the MPGs, the inventory for the whole time series should be estimated using the same methodologies, and the underlying activity data and emissions factors should be used in a consistent manner, ensuring that changes in emissions trends are not introduced as a result of changes in estimation methods. Thus, recalculations of past emissions data occur every year based on GHG inventory improvements by countries, which should ensure the consistency of the time series and be carried out to improve the accuracy and/or completeness of the inventory.

Figure ES.2 shows the absolute and relative differences in the 2024 and the 2025 submission for all years. From 1990 to 2017, recalculations have changed the overall emission trend only marginally by less than 0.5 %. But from 2018 onwards, the impact of recalculations increased significantly mainly due to recalculations in the LULUCF sector. The key reasons for the big recalculations in the LULUCF sector are the availability of new National Forest Inventory data for forest land (4.A), which led to substantial corrections of previously reported estimates in some MS, as well as better data for cropland with new and adjusted models for soil carbon together with more sample plots in both organic and mineral soils (4.B).

In the previous submission total EU GHG emissions (with LULUCF) decreased by 32.6 % between 1990 and 2022, and in the latest submission they decreased by 31.1% during the same time.

Figure ES. 2 Absolute and relative difference of total EU GHG emission trends 1990–2022 (with LULUCF) between the latest and the previous submission



ES-4 KEY CATEGORY ANALYSIS

A level and a trend assessment was carried out for the years 1990 and 2023 for emissions excluding LULUCF and including LULUCF.

The key category analysis including LULUCF identified 94 key categories for the EU covering 95.1% of total EU GHG emissions in 2023 while the key category analysis excluding LULUCF resulted in 79 key categories.

ES-5 IMPROVEMENTS INTRODUCED

In 2024, the EU adapted its reporting to the first inventory under the Paris Agreement. The NID outline has been amended to be in line with the new reporting guidelines. Descriptions of categories have been aligned accordingly. Information across sectors has been streamlined to provide a harmonised approach across the whole NID. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

In 2025, the transparency of the information in the EU NID has been further improved. In response to the in country, review of the EU GHG inventory in February 2025 several small adaptations/improvements have been implemented. The EU will continue to improve the transparency of its NID and provide more detailed information based on the recommendations included in the final review report, which was not available at the time of submission of this report.

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1 NATIONAL CIRCUMSTANCES, INSTITUTIONAL ARRANGEMENTS AND CROSS-CUTTING INFORMATION

This report is the official inventory submission of the European Union (EU) for 2025 under the United Nations Framework Convention on Climate Change (UNFCCC) and follows the modalities, procedures and guidelines (MPGs) under the Enhanced Transparency Framework (ETF) of the Paris Agreement (Decisions 18/CMA.1 and 5/CMA.3).

The European Union (EU), as a party to the Paris Agreement and to the United Nations Framework Convention on Climate Change (UNFCCC), reports annually on greenhouse gas (GHG) inventories for the years between 1990 and the current calendar year (t) minus two (t-2), for emissions and removals within the area covered by its 27 Member States (i.e. emissions taking place within the EU territory). The EU Member States are: 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. . Even though not all Member States were part of the European Union in 1990, GHG emissions in the EU are time-series consistent since 1990 and account for all sources and sinks of the current 27 EU MS. For reasons of clarity, please note that in some cases the terms 'Member States' and ''EU' and 'Union' may be used.

This chapter aims to present transparent information on the process and methods of compiling the EU GHG inventory. It addresses the relevant aspects at EU level, but does not describe detailed sectoral methodologies of the Member States' GHG inventories. The EU GHG inventory is based on the GHG inventories of its Member States[7]. They are responsible for the methods, emissions, emission factors, and other activity and background data reported in their GHG inventories, and will consider national inventory priorities and any resource constraints when estimating and reporting emissions and removals according to the MPGs and the IPCC Guidelines based on the data available in the country.

As the data used in the EU inventory are the aggregation of emissions and removals of the 27 Member States inventories, the detailed sectoral methodologies used in the EU inventory are fully consistent with the methodologies reported by the Member States to both the EU and UNFCCC. As such, the complete details on the methodologies used by the Member States are available in the national inventory reports of the Member States, which are submitted to the UNFCCC and published in the UNFCCC website. To facilitate the work of the expert review teams during the annual UNFCCC review process, and as follow up to previous review recommendations, the EU submission in 2025 includes an Annex (Annex III) with a summary description of the methodologies used by each Member State for the EU key categories. The more detailed descriptions can be found in Member State's own submissions. Note that all Member States' submissions (common reporting format (CRT) tables and inventory reports), are considered to be part of the EU inventory. Several chapters in this report refer to information provided by the Member States, where additional insights can be gained. In many cases this Member State information is presented in summary overview tables.

The EU greenhouse gas inventory has been compiled under Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action [8] (hereafter referred to as the Governance Regulation). The emissions compiled in the EU GHG inventory are the sum of the respective emissions in the respective national inventories, except for the Intergovernmental Panel on Climate Change (IPCC) reference approach for CO_2 emissions from the combustion of fossil fuels, where energy statistics from Eurostat are used.

[7] The EU Greenhouse gas inventory data in this report was compiled using the September 2024 release of the 'CRT reporting tool' developed by the UNFCCC Secretariat. Because of the ongoing improvements in the ETF tool by the UNFCCC secretariat after the compilation of the EU GHG inventory, reported data may differ from actual inventory data in some cases. The EU should not be held responsible for any remaining technical issues and errors caused by the CRT electronic tool affecting the quality of the GHG inventory during the technical expert review

[8] OJ L 328, 21.12.2018, p. 1–77 .

1.1 Background information on greenhouse gas inventories and climate Change

The annual EU GHG inventory is required for two purposes.

Firstly, the EU, as the only regional economic integration organisation having joined the Paris Agreement and the UNFCCC as a Party, has to report annually on GHG inventories within the area covered by its Member States.

Secondly, under the EU Governance Regulation, the European Commission has to assess annually whether the actual and projected progress of Member States is sufficient to ensure fulfilment of the EU's commitments under the UNFCCC, and with respect to EU legislation for reduction of GHG emissions (Effort Sharing Regulation)[9]. For this purpose, the Commission has to prepare a progress evaluation report (State of the Energy Union Report), which has to be forwarded to the European Parliament and the Council. The annual EU inventory is used for the evaluation of actual progress.

Regarding the review process under the Paris Agreement and the UNFCCC, the following conclusions from the GHG lead reviewers are of particular relevance to the EU

Conclusions of the 16th meeting of GHG lead reviewers[10]:

Reviewing the GHG inventory of the European Union (EU): the LRs noted that the review of the EU submission is unique in that it is the direct sum of emissions and removals from the national inventories compiled by the EU member States as well as Iceland, and that individual member States as well as Iceland are also subject to an inventory review. The LRs further noted that the focus of the EU review should be on ensuring that the EU submission accurately reflects the summation of the emissions and removals of its member States as well as Iceland and that information is transparently reported in the EU NID, particularly for key categories identified at the level of the EU. Recommendations directed at specific member States as well as Iceland are beyond the scope for inclusion in the ARR of the EU. The LRs encouraged the secretariat to conduct the review of the EU submission after the submissions from individual EU member States and Iceland have been reviewed;

Conclusions of the 19th meeting of GHG lead reviewers, on the scope of and approach to the review of the EU GHG inventory[11]:

The LRs concluded that the conclusions from the 16th meeting of LRs on the focus of the EU review, considering elements of the conclusions from the 3rd meeting of LRs, should be supplemented with the following recommendations for ERTs:

(i) At the start of the review, the LRs should request the ERT to focus the review on the transparency of the information reported in the EU national inventory report and provide guidance thereon, particularly for key categories identified at the EU level, followed by categories for which recalculations have been performed, and categories that are the subject of recommendations in the previous review report, as well as for findings in the initial assessment and progress in the implementation of planned improvements. The LRs recalled that the EU GHG inventory is compiled from the national GHG inventories of the EU member States, Iceland and the United Kingdom of Great Britain and Northern Ireland

[9] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (OJ L 156, 19.6.2018, p. 26–42.

[10] https://unfccc.int/sites/default/files/resource/04_GHG-LRs-2019-conclusions_0.pdf

[11] https://unfccc.int/sites/default/files/resource/Nineteenth%20meeting%20of%20Inventory%20Lead%20Reviewers.pdf

and that the ERT should assess whether the EU GHG inventory is compiled in accordance with the UNFCCC Annex I inventory reporting guidelines.

The LRs should ensure that recommendations in the review report are addressed to the EU, because the inventories of the member States, Iceland and the United Kingdom fall outside the scope of the EU review.

(ii) The LRs noted that the ERT may also consider information on the efforts undertaken at the EU level to address the main issues pertaining to the member States, Iceland and the United Kingdom, as reflected in previous EU review reports.

1.2 A description of the institutional arrangements

1.2.1 Institutional, legal and procedural arrangements among entities involved

In accordance with the Governance Regulation Article 37(3), a Union Inventory system is established to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of national inventories with regard the Union greenhouse gas inventory. The QA/QC programme outlines the main elements of the Union inventory system. An overview is presented Figure 1.1.

The Directorate General Climate Action of the European Commission has overall responsibility for the inventory of the European Union (EU) while each Member State is responsible for the preparation of its own inventory which is the basic input for the inventory of the European Union. DG Climate Action is supported in the establishment of the inventory by the following main institutions: the European Environment Agency (EEA) and its European Topic Centre on Climate Change Mitigation (ETC/CM) as well as the DG Eurostat[12].

The legal basis of the compilation of the EU inventory is the Governance Regulation and Commission Implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014[13]. The Governance Regulation and the implementing regulation establish a mechanism for inter alia: (1) ensuring the timeliness, transparency, accuracy, consistency, comparability and completeness of reporting by the Union and its Member States to the UNFCCC Secretariat; (2) reporting and verifying information relating to commitments of the Union and its Member States pursuant to the UNFCCC and the Paris Agreement and to decisions adopted thereunder and evaluating progress towards meeting those commitments; (3) monitoring and reporting all anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol on substances that deplete the ozone layer in the Member States; (4) evaluating progress by the Member States towards meeting their obligations under the Effort Sharing Regulation.

Under the provisions of Article 26(3) of the Governance Regulation and Articles 8-18 of the Commission Implementing Regulation 2020/1208, the Member States shall determine and report to the Commission by 15 January each year (year X) inter alia:

- their anthropogenic emissions of greenhouse gases listed in Annex I of the MMR (same as in Annex A to the Kyoto Protocol) for the year X-2, in accordance with UNFCCC reporting requirements

[12] The Statistical Office of the European Communities (Eurostat) is a DG of the European Commission. For simplicity reasons, this institution is referred to as ‘Eurostat’in this report.

[13] OJ L 278, 26.8.2020, pp. 1–132

- data in accordance with UNFCCC reporting requirements on their anthropogenic emissions of carbon moNO$_x$ide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_X) and volatile organic compounds, for the year X-2
- their anthropogenic greenhouse gas emissions by sources and removals of CO_2 by sinks resulting from LULUCF, for the year X-2, in accordance with UNFCCC reporting requirements
- any changes to the information referred to in points above relating to the years between 1990 and the year three-years previous (year X – 3);
- the elements of the national inventory report necessary for the preparation of the EU greenhouse gas inventory report, such as information on the Member State's quality assurance/quality control plan, a general uncertainty evaluation, a general assessment of completeness, information on methods and emission factors used, and information on recalculations performed.

Submissions of updated or additional inventory data and complete national inventory reports by Member States shall be reported by 15 March.

Specific requirements on structure, format, submission processes under the Governance Regulation are detailed in the Commission Implementing Regulation 2020/1208. According to the Governance Regulation and its implementing decision, the reporting requirements are exactly the same as for the UNFCCC, regarding content and format. The EU and its Member States prepare the inventory according to the relevant provisions under the UNFCCC.

In relation to the UNFCCC review of the EU GHG inventory, it is relevant to highlight that the EU GHG inventory is based on the inventories of its MS. They are responsible for the methods, emission factors and emissions used, and for the implementation of the UNFCCC reporting guidelines and the 2006 IPCC Guidelines, taking into account inventory priorities and resource constraints.

The unique nature of the EU GHG inventory has been recognized by the GHG lead reviewers and is reflected in their conclusions (16th and 19th meetings, respectively).

Figure 1.1 Inventory system of the European Union

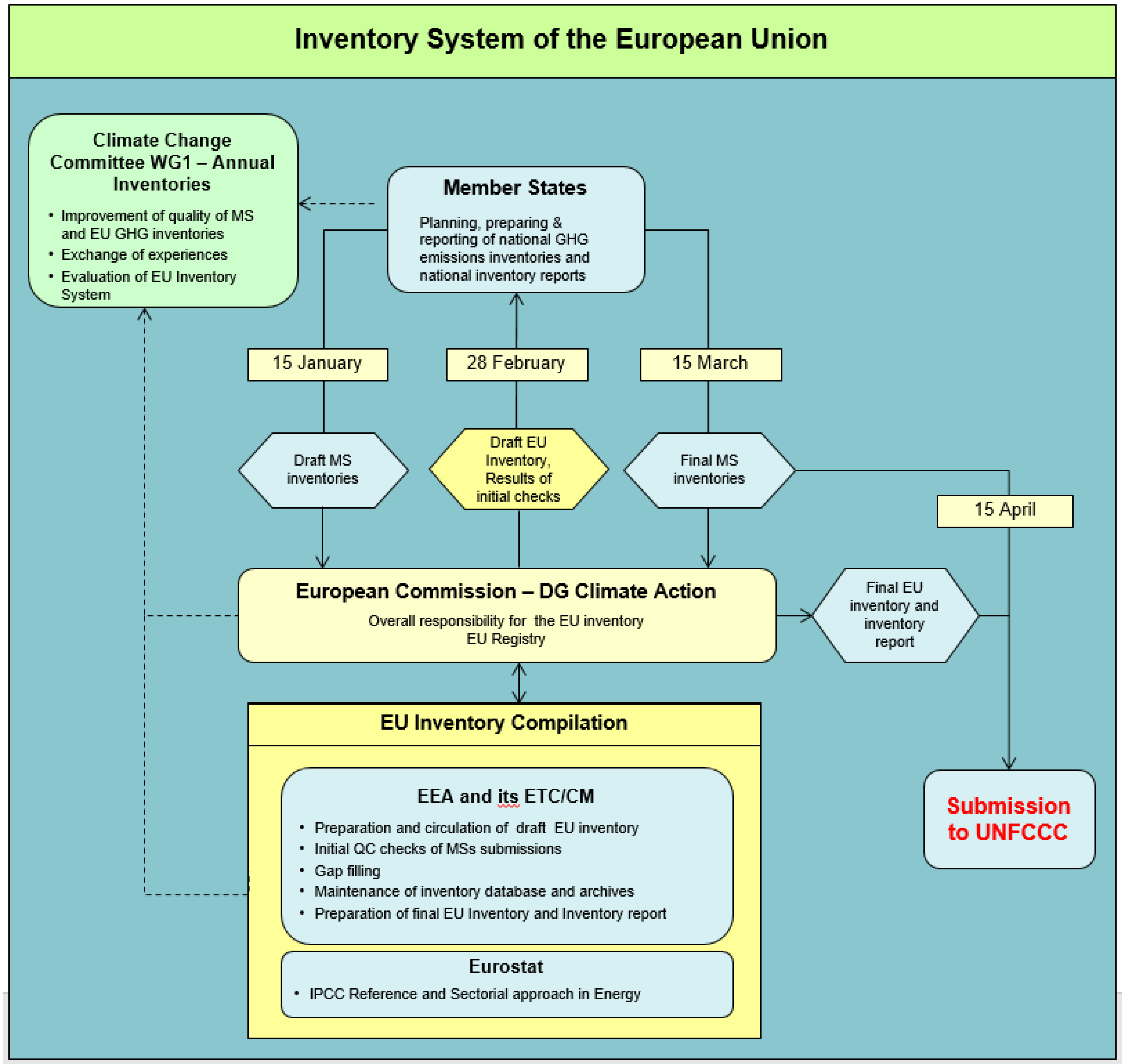

Figure 1.1 shows the main institutions involved in the compilation and submission of the EU inventory.

1.2.1.1 The Member States

All EU Member States are Parties to UNFCCC and the Paris Agreement and have to prepare national GHG inventories in accordance with the MPGs and submit those inventories to the UNFCCC secretariat by 15 April.

In this context, all Member States are required to establish, operate and seek to continuously improve national inventory systems in accordance to Article 37(1) of the Governance Regulation. Detailed information on institutional arrangements/national systems of each Member State is included in the respective national inventory reports.

The European Union's inventory is based on the inventories reported to the EU by Member States. The total estimate of the EU greenhouse gas emissions should accurately reflect the sum of Member States' national greenhouse gas inventories. Member States are responsible for choosing activity data, emission factors and other parameters used for their national inventories as well as the correct application of methodologies provided in the 2006 IPCC Guidelines. Member States are also responsible for establishing quality assurance/quality control (QA/QC) programmes for their inventories. The QA/QC activities of each Member State are described in the respective national inventory reports.

For the EU to be able to provide the GHG inventory to the UNFCCC on time, all Member States are required to report individual GHG inventories prepared in accordance with the MPGs to the European Commission and to the European Environment Agency (EEA) by 15 January every year.

After the submission of national GHG inventories and inventory reports, QA/QC checks are performed by the EU team. The outcome of these 'initial checks', together with the draft EU inventory report is sent to Member States for checking, reviewing and providing of comments. The Member States take part in the review and comment phase of the draft EU inventory report. The purpose of circulating the draft EU inventory report is to improve the quality of the EU inventory. The Member States check their national data and information used in the EU inventory report, answer to the initial checks findings and send updates, as relevant by the 15th March. In addition, they can comment on the general aspects of the EU inventory report by the same deadline.

During the UNFCCC review of the Union inventory, Member States are also required to provide answers related to the issues under their responsibility as soon as possible. In these cases, the issues are forwarded directly as requested by the EU team.

The inventory authorities of the Member States take part in the Working Group 1 'Annual Inventories' (WG1) of the Climate Change Committee established under the Governance Regulation. The purpose of the Climate Change Committee is to assist the European Commission in its tasks under the Governance Regulation. Information on the WG1 tasks and responsibilities can be found in the next paragraph, but the main task of the WG1 members is to ensure the coordination of inventory activities between the Union system and the national inventory systems.

1.2.1.2 The European Commission, Directorate-General Climate Action

The European Commission's DG Climate Action in consultation with the Member States has the overall responsibility for the EU inventory. Member States are required to submit their national inventories and inventory reports under the Governance Regulation to the European Commission, DG Climate Action; and the European Commission, DG Climate Action itself submits the inventory and inventory report of the EU to the UNFCCC Secretariat, on behalf of the European Union. In the actual compilation of the EU inventory and inventory report, the European Commission, DG Climate Action, is assisted by the EEA including the EEA's ETC/CM and by Eurostat.

The consultation between the DG Climate Action and the Member States takes place in the Climate Change Committee established under Article 44(1)(a) of the Governance Regulation. The Committee is composed of the representatives of the Member States and chaired by the representative of the DG Climate Action. In order to facilitate decision-making in the Committee, working groups have been established, one of which is Working Group 1 on 'Annual inventories'. The objectives and tasks of Working Group 1 under the Climate Change Committee include:

- the promotion of the timely delivery of national annual GHG inventories as required under the Governance Regulation;
- the improvement of the quality of GHG inventories on all relevant aspects (transparency, consistency, comparability, completeness, accuracy and use of good practices);
- the exchange of practical experience on inventory preparation, on all quality aspects and on the use of national methodologies for GHG estimation;
- the evaluation of the current organisational aspects of the preparation process of the EU inventory and the preparation of proposals for improvements where needed.

1.2.1.3 The European Environment Agency

Under Article 42 of the Governance Regulation the role of the European Environment Agency (EEA) is defined as providing assistance to the Commission in its work. In relation to the inventories, this assistance includes the following:

(a) Compilation of the Union greenhouse gas inventory and preparation of the Union greenhouse gas inventory report;
(b) Performance of the quality assurance and quality control procedures for the preparation of the Union greenhouse gas inventory;
(c) Preparation of estimates for data not reported in the national greenhouse gas inventories;
(d) Conduction of the reviews of MS inventories.

The tasks of the EEA are facilitated by the European environmental information and observation network (Eionet), which consists of the EEA as central node (supported by European topic centres) and national institutions in the EEA member countries[14] (see http://eionet.eea.europa.eu). Member States report the information reported pursuant to Article 26(3) of the Governance Regulation to the Commission with a copy to the European Environment Agency, and for this reason they are making use of the EEA's ReportNet's Central Data Repository under the Eionet ('CDR', see http://cdr.eionet.europa.eu/).

Apart from the data capturing processes, and as part of its responsibility to compile the GHG inventory and prepare the Union GHG inventory report, the EEA is also responsible for the implementation of the QA/QC Programme of the EU, by performing inter alia a number of QA/QC checks focused on ensuring the completeness and consistency of the Union and Member States inventories. Since 2023 EEA is also responsible for initial checks and compilation of NID chapters for the sectors agriculture and LULUCF (supported by ETC/CM – see below); in previous years these tasks were carried out by the Directorate General Joint Research Centre of the European Commission.

Finally, in the end of the process the EEA publishes the GHG inventory dataset and the EU National Inventory Report on its website. To facilitate the access of the GHG information to the general public, the EEA data viewer is also provided.

The EEA is further assisted by its European Topic Centre on Climate Change Mitigation (ETC/CM), which is an international consortium working with the EEA under a framework partnership agreement. The activities of the EEA's ETC/CM are further deployed in the next paragraph.

1.2.1.4 The European Topic Centre on Climate Change Mitigation

The EEA's European Topic Centre on Climate Change Mitigation (ETC/CM) was established by a contract between the lead organisation Vito (vision on technology) in Belgium and EEA for the years 2022-2026, continuing on part of the work of the previous ETC/CME on Climate change Mitigation and Energy, which ended in 2021.

The EEA's ETC/CM involves 15 organisations and institutions in ten European countries. The technical annex of the work plan for the EEA's ETC/CM and a yearly action plan defines the specific tasks of the EEA's ETC/CM partner organisations with regard to the preparation of the EU inventory and inventory report. Environment Agency Austria is the task leader for the compilation of the EU annual inventory and inventory report in the EEA's ETC/CM. The specific tasks undertaken by EEA's ETC/CM in this task include:

- Implementation of the quality assurance and quality control (QA/QC) procedures of the EU GHG inventory national system for the compilation and submission of the Union GHG inventory to the UNFCCC. Initial QA/QC checks of Member States' submissions are performed in cooperation with Eurostat and documented in the EEA review tool;

[14] EEA member countries include the EU Member States, Iceland, Liechtenstein, Norway, Switzerland and Turkey.

- Performing the first step of the annual Effort Sharing Regulation (ESR) review and identifying significant issues according to Art. 30 and Annex XXII of the Commission Implementing Regulation 2020/1208;
- Consultation with Member States in order to clarify data and other information provided;
- Preparation of the draft EU inventory and inventory report by 28 February based on Member States' submissions;
- Preparation of the final EU inventory and inventory report by 15 April (to be submitted by the Commission to the UNFCCC Secretariat).

The European Environment Agency provides database systems and queries on EEA CWS environment developed to ensure the EU submission is fully consistent with member state's (MS) submissions. From CWS the aggregated EU inventory is transferred into the CRT reporter software for preparing the official EU GHG submission.

1.2.1.5 Eurostat

Eurostat collects national energy statistics reported under the EU Energy Statistics Regulation on an annual basis. These data are used for the estimation of the IPCC Reference Approach and the Sectoral Approach. The EEA compares the results of the two approaches with MS CRT submissions. These comparisons are normally sent to MS during the consultation on the Draft EU GHG inventory by 28 February. The Energy Statistics Regulation (Regulation EC/1099/2008) as amended by Commission Regulation (EU) No 147/2013 of 13 February 2013 is the basis for MS reporting of energy data to Eurostat. Article 6(2) of the Energy statistics regulation stipulates: 'Every reasonable effort shall be undertaken to ensure coherence between energy data declared in the energy statistics regulation, and data declared in accordance with Commission Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol'. The consistency of energy balances and CRT activity data is essential for good quality GHG estimates in the energy sector, and therefore it is at the core of the QA/QC activities at EU level.

1.2.2 Inventory preparation process

The annual process of compilation of the EU inventory is summarised in Table 1.1. The Member States submit their annual GHG inventory by 15 January each year to the European Commission's DG Climate Action using the EEA's Reportnet Central Data Repository. Then, EEA's ETC/CM performs initial checks of the submitted data up to 28 February. The ETC/CM transfers the nationally submitted data from the JSON-files into the EEA database. The data are aggregated and transferred into the CRT reporter software for preparing the official EU GHG inventory submission. Any information reported by MS in categories that do not have standardized UIDs or in categories for which several country settings are possible have to be included in the CRT Reporter manually.

Table 1.1 Annual process of submission and review of Member States inventories and compilation of the EU inventory[15]

Element	Who	When	What
1. Submission of annual inventories (complete CRT and elements of the national inventory report) by Member States	Member States	15 January	Elements listed in Article 26(3) of the Governance Regulation
2. 'Initial checks' of Member States submissions	Commission (incl. Eurostat), assisted by the EEA	For the Member State submission	Checks to verify the transparency, accuracy, consistency, completeness and comparability of Member States'

[15] At COP27 in Sharm COP decision (4/CP.27 Revision of the modalities and procedures for international assessment and review) clarifying that the date was moved to not later than 31 December 2024.

Element	Who	When	What
		from 15 January at the latest until 28 February	inventories (by EEA). Comparison of energy data provided by Member States in the CRT with Eurostat energy data (sectoral and reference approach) by Eurostat and EEA. Check of Member States' agriculture inventories by EEA (in consultation with Member States). Check of Member States' land use, land-use change and forestry (LULUCF) inventories by EEA (in consultation with EEA and Member States).The findings of the initial checks will be documented.
3. Compilation of draft Union inventory and inventory report (elements of the Union inventory report)	Commission (incl. Eurostat), assisted by the EEA	up to 28 February	Draft Union inventory and inventory report (compilation of Member State information), based on Member State inventories and additional information where needed (as submitted on 15 January).
4. Circulation of 'initial check' findings including notification of potential gap-filling	Commission (DG Climate Action) assisted by the EEA	28 February	Circulation of 'initial check' findings including notification of potential gap-filling and making available the findings
5. Circulation of draft **Union** inventory and inventory report	Commission (DG Climate Action) assisted by the EEA	28 February	Circulation of the draft Union inventory on 28 February to Member States. Member States check data.
6. Submission of updated or additional inventory data and complete national inventory reports by Member States	Member States	15 March	Updated or additional inventory data submitted by Member States (to remove inconsistencies or fill gaps) and complete national inventory reports.
7. Member State commenting on the draft Union inventory	Member States	15 March	If necessary, provide corrected data and comments to the draft Union inventory
8. Member State responses to the 'initial checks'	Member States	15 March	Member States respond to 'initial checks' if applicable.
9. Circulation of follow-up initial check findings	Commission assisted by EEA 31 March	Commission assisted by EEA 31 March	Circulation of follow-up initial check findings and making available the findings
10. Estimates for data missing from a national inventory	Commission (DG Climate Action) assisted by EEA	31 March	The Commission prepares estimates for missing data by 31 March of the reporting year, following consultation with the Member State concerned, and communicate these to the Member States.
11. Comments from Member States regarding the Commission estimates for missing data	Member States	7 April	Member States provide comments on the Commission estimates for missing data, for consideration by the Commission.
12. Member States responses to follow-up 'initial checks'	Member States	7 April	Member States provide responses to follow up of 'initial checks'.
13. Member States submissions to the UNFCCC	Member States	15 April	Submissions to the UNFCCC (with a copy to EEA)
14. Final annual Union inventory (incl. EU inventory report)	Commission (DG Climate Action) assisted by EEA	15 April	Submission to UNFCCC of the final annual Union inventory.
15. Submission of any other resubmission after the initial check phase	Member States	When additional resubmissions occur	Member States provide to the Commission any other resubmission (CRT or national inventory report) which they provide to the UNFCCC secretariat after

By 28 February, the draft EU GHG inventory and inventory report are circulated to the Member States for review and comment. The Member States check their national data and information used in the EU inventory report and send updates, if necessary, and review the EU inventory report by 15 March. This procedure should assure the timely submission of the EU GHG inventory and inventory report to the UNFCCC Secretariat and it should guarantee that the EU submission to the UNFCCC Secretariat is consistent with Member States' UNFCCC submissions.

The final EU GHG inventory and inventory report is prepared by the EEA's ETC/CM by 15 April for submission to the UNFCCC Secretariat. After the submission to UNFCCC the inventory and the inventory report are published on the EEA website (http://www.eea.europa.eu) and the data are made available through the EEA data service (http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-9) and the EEA GHG data viewer (http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer.)

The EU inventory is compiled in accordance with Decision 18/CMA.1 Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, Annex Chapter II 'UNFCCC guidelines for the preparation of national communications by parties included in Annex 1 to the Convention, Part 1: UNFCCC reporting guidelines on annual inventories' (FCCC/CP/2013/10/Add.3),and Decision 18/CMA.1 and 5/CMA.3. The *2006 IPCC guidelines for national greenhouse gas inventories* have been applied. The 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been used on a voluntary basis by Member States, where appropriate and feasible. Finally, for the compilation of the EU GHG inventory, the Governance Regulation and its implementing legislation is applicable.

The EU GHG inventory is compiled on the basis of the inventories of the 27 Member States. The emissions of each source category are the sum of the emissions of the respective source and sink categories of the Member States.

The reference approach is calculated for the EU on the basis of Eurostat energy data (see Section 3.6) and the key category analysis (Section 1.5) is separately performed at EU level[16]. Note that in 2025 the reference approach cannot be calculated due to persistent problems with the UNFCCC ETF tool. However, the comparisons between Member States' energy data reported in GHG inventories and Member States' energy data reported to Eurostat have been made as part of the initial QA/QC checks and would be available to the technical expert review team. Since Member States use different national methodologies, national activity data or country-specific emission factors in accordance with IPCC and the MPGs, these methodologies are reflected in the EU GHG inventory data. The EU believes, and the review process has confirmed, that it is consistent with Decision 18.CMA.1 of the Enhanced Transparency Framework under the Paris Agreement to use different methodologies for the same category across the EU as this reduces the uncertainty of emissions and removals, provided that the methodologies used are consistent with the 2006 IPCC Guidelines and its 2019 refinement..

In general, no separate methodological information is provided at EU level except summaries of methodologies used by Member States. Annex III includes a summary description of the methodologies used by each Member State for the EU key categories. The more detailed descriptions can be found in Member State's own submissions, which are considered to be part of the EU inventory.

1.2.2.1 Internal consistency of the EU CRT tables

In principle, every single EU value is aggregated from the respective value of the EU Member States. However, sometimes there are consistency problems when compiling the EU CRT tables (i.e. the sum of sub-categories is not equal to the category total) in those categories where Member States have difficulties to allocate emissions to the sub-categories. Member States use notation keys like IE or C if they cannot provide an emission estimate for a certain sub-category. At Member State level, the use of the notation keys makes transparent the reason for not providing emission estimates. However, at EU-level, the sub-category emission value is the sum of Member States emission values and the information of the notation keys used by some Member States is lost in the EU CRT submission. In order to make this more transparent, the CRF tables include the values or notation keys reported by the MS as

[1616] However, the choice of the emission calculation methodology is made at Member State level and is based on the key category analysis of each individual Member State.

comments. In order to address this problem, some source categories have been reallocated for the EU CRT tables.

A second problem is the reporting of Member States in “grey cells” or in categories that do not have standardized UIDs which then need to be included in the CRT reporter manually.

As the EU is currently not able to import into the ETF tool the json file (that contains the aggregated data of all MS’ submissions) no manual changes have been performed in this submission. The EU CRT tables submitted as part of its 15 April inventory under the Convention are based on the aggregation of standard variables reported in the inventories of its Member States. Country-specific variables cannot be imported due to outstanding issues with the ETF tool. The UNFCCC secretariat is improving the ETF tool to allow this specific, and crucial issue to the EU, be resolved swiftly so that the EU can re-submit its CRT tables including country-specific variables. It is important to highlight that no emissions or removals are missing from the CRT tables, but that the level of disaggregation has been affected. The EU has all the information reported by Member States in the GHG inventories submitted to the EU, which has been used for the production of the EU’s NID. All emissions and removals are also available from the data viewers and databases published on the EEA website.

1.2.2.2 Overview of Member States submissions

Table 1.2 summarises timeliness and completeness of the EU Member States submissions in 2025 that were taken into account for the compilation EU GHG inventory.

Table 1.2 Date, mode and content of submission of EU Member States in 2025 that were taken into account for the compilation of EU GHG inventory

MS	Date	Submission mode	JSON	NID
AUT	14.03.2025	CDR	AUT-CRT-2025-V0-3-DataEntry-20250313-163139	x
BEL	15.03.2025	CDR	BEL-CRT-2025-V0-9-DataEntry-20250314-103619	x
BGR	17.03.2025	CDR	BGR-CRT-2025-V0-2-DataEntry-20250317-154159	x
CYP	20.03.2025	CDR	CYP-CRT-2025-V1-0-DataEntry-20250320-123951	x
CZE	14.03.2025	CDR	CZE-CRT-2025-V0-2-DataEntry-20250314-120458	x
DEU	17.03.2025	CDR	DEU-CRT-2025-V0-4-DataEntry-20250317-161830	x
DNK	14.03.2025	CDR	DNK-CRT-2025-V0-2-DataEntry-20250314-143252	x
ESP	13.03.2025	CDR	ESP-CRT-2025-V0-2-DataEntry-20250312-125754	x
EST	14.03.2025	CDR	EST-CRT-2025-V0-2-DataEntry-20250314-084216	x
FIN	14.03.2025	CDR	FIN-CRT-2025-V0-7-DataEntry-20250307-121503	x
FRA	14.03.2025	CDR	FRA-CRT-2025-V0-2-DataEntry-20250313-163728	x
GRC	14.03.2025	CDR	GRC-CRT-2025-V0-2-DataEntry-20250304-173225	x
HRV	14.03.2025	CDR	HRV-CRT-2025-V0-1-DataEntry-20250314-073454	x
HUN	19.01.2025	CDR	HUN-CRT-2025-V0-2-DataEntry-20250319-220252	
IRL	14.03.2025	CDR	IRL-CRT-2025-V1-2-DataEntry-20250314-123139	x
ITA	14.03.2025	CDR	ITA-CRT-2025-V0-2-DataEntry-20250313-140434	x
LTU	15.03.2025	CDR	LTU-CRT-2025-V0-2-DataEntry-20250314-174933	x
LUX	14.03.2025	CDR	LUX-CRT-2025-V0-3-DataEntry-20250303-111104	x
LVA	14.03.2025	CDR	LVA-CRT-2025-V0-3-DataEntry-20250312-102343	x
MLT	13.03.2025	CDR	MLT-CRT-2025-V0-5-DataEntry-20250306-114918	x
NLD	14.03.2025	CDR	NLD-CRT-2025-V0-9-DataEntry-20250313-093247	x
POL	14.03.2025	CDR	POL-CRT-2025-V0-2-DataEntry-20250314-110010	x
PRT	15.03.2025	CDR	PRT-CRT-2025-V0-6-DataEntry-20250314-154148	x

MS	Date	Submission mode	JSON	NID
ROU	14.03.2025	CDR	ROU-CRT-2025-V1-8-DataEntry-20250227-141419	x
SVK	13.03.2025	CDR	SVK-CRT-2025-V0.3_15-03-2025	x
SVN	14.03.2025	CDR	SVN-CRT-2025-V1-1-DataEntry-20250312-100531	x
SWE	14.03.2025	CDR	SWE-CRT-2025-V0-5-DataEntry-20250213-130509	x

1.2.2.3 Overview of personnel involved

Table 1.3 gives an overview on people involved in the compilation of the EU GHG inventory submission in 2025 and their individual responsibilities in this process.

Table 1.3 Responsibility list for the compilation of the EU GHG inventory submission in 2025

	Name	EU GHG inventory/inventory report compilation				Initial Checks			
		Overall responsibility	Project manager	Sector experts	Quality expert	Overall responsibility	QA/QC coordinator	Sector experts/ expert	Quality expert
Commission	Roxanne Lake (DG Clima)	X			Executive summary, introduction				
	GENET Julien (CLIMA)	X			Executive summary, introduction				
	HLAVACEK Jan (DG Clima)	X			Executive summary, introduction				
	Michael Goll (Eurostat)			1A Reference approach				1A Reference approach	
EEA	Ricardo Fernandez (EEA)	X			Executive summary, chapter 1, trend chapter, chapter 10	X			
	Claire Qoul (EEA)	X			Executive summary, chapter 1, trend chapter, chapter 10	X			
	Peter Iversen (EEA)				sector 4				sector 4
	Raul Abad-Vinas (EEA)			sector 4				sector 4	
	Herdis Gudbrandsdottir (EEA)			Data checks					
	Gorka Mendiguren (EEA)			plots all sectors				plots sector 3, plots all sectors	
	Ondrej Pastierik (EEA)				sector 3				sector 3
	Katarzyna Kowalczewska (EEA)				sector 3				sector 3
	Michaela Gager (ETC/CM; UBA-V)		Data manager	support				support	
ETC/CM	Günther Schmidt (ETC/CM; UBA-V)		Data manager						
	Nicole Mandl (ETC/CM; UBA-V)		X	Executive summary, introduction, trend chapter			X	cross-cutting issues	cross-cutting issues
	Bernd Gugele (ETC/CM; UBA-V)			1A reference approach, support				1A reference approach	

Name	EU GHG inventory/inventory report compilation				Initial Checks			
	Overall responsibility	Project manager	Sector experts	Quality expert	Overall responsibility	QA/QC coordinator	Sector experts/ expert	Quality expert
Bradley Matthews (ETC/CM; UBA-V)			uncertainties				uncertainties	
Manuela Wieser (ETC/CM; UBA-V)				sector 2 - F-gases only				sector 2 - F-gases only
Maria Purzner (ETC/CM; UBA-V)				sector 2 - F-gases only				sector 2 - F-gases only
Marion Pinteris (ETC/CM; Klarfakt)		Support	1B, 1C	reference approach			1B, 1C	reference approach
Elisabeth Kampel (ETC/CM, Klarfakt)		Support	chapter 10					
Barbora Koci (ETC/CM; CHMI)			1A4, 1A5				1A4, 1A5	
Jitka Slamova (ETC/CM; CHMI)			1A2				1A2	
SAARIKIVI RISTO JUHANA (ETC/CM; CHMI)				sector 5				sector 5
Monika Filipenska (ETC/CM;CHMI)				1A1				1A1
Céline GUEGUEN (ETC/CM; T4L)			sector 5				sector 5	
Coralie JEANNOT (ETC/CM; CITEPA)			EU ETS, 2C				EU ETS, 2C	
Grégoire Bongrand (ETC/CM; CITEPA)			EU ETS, 2C				EU ETS, 2C	
Julien Vincent (ETC/CM; CITEPA)			1A1, 2D, 2G3-2G4, 2H	1A2, 1A4, 1A5; 1B, 1C			1A1, 2D, 2G3-2G4, 2H	1A2, 1A4, 1A5; 1B, 1C
Etienne MATHIAS (ETC/CM; CITEPA)				sector 3				sector 3
Anais Durand (ETC/CM; CITEPA)			sector 3				sector 3	
Athina Grigoriadou (ETC/CM; Emisia)			1A3 + bunkers, comparison with Eurocontrol				1A3 + bunkers	

	Name	EU GHG inventory/inventory report compilation				Initial Checks			
		Overall responsibility	Project manager	Sector experts	Quality expert	Overall responsibility	QA/QC coordinator	Sector experts/ expert	Quality expert
	Giannis Papadimitriou (ETC/CM; Emisia)				1A3 + bunkers, comparison with Eurocontrol				1A3 + bunkers
	Barbara Gschrey (ETC/CM; Oeko Recherche)			F-gases, 2B9 2E, 2F, 2G1-2				F-gases, 2B9 2E, 2F, 2G1-2	
	David Behringer (ETC/CM; Oeko Recherche)			F-gases, 2B9 2E, 2F, 2G1-2				F-gases, 2B9 2E, 2F, 2G1-2	
	Lorenz Moosmann (ETC/CM; Oeko)			sectors 2A, 2B				2A, 2B	
	Lukas Emele (ETC/CM; Oeko)			sectors 2A, 2B				2A, 2B	
	Ils Moorkens (ETC/CM; VITO)				sector 2 (excl. F-gases)				sector 2 (excl. F-gases)

1.2.3 Documentation and archiving

The documentation consists of quality management documentation in forms, checklists, inventory reports and correspondence. Archiving includes archiving of inventory documents and QM documents; a systematic archiving procedure is a prerequisite for a transparent inventory system.

All the material used for the compilation of the EU GHG inventory including inventory documents and QM documents are posted in a separate folder at the Environment Agency Austria , which is not publicly accessible:

There are four sub-directories under this directory:

1. \Inventory
2. \Archive
3. \Quality manual
4. \General

The Member States submissions and all correspondence are stored in the sub-directory\Archive. The central tool for documenting all the material received from MS (including correspondence) is the MS archive database which includes references, short characterisations and links to e-mails for all MS submissions. The MS archive database can be searched for documents (CRT, JSON, NID, etc.) or for mails. Each submission is numbered consecutively.

1.2.4 Processes for official consideration and approval of inventory

The report is prepared and approved by EEA. The official submission is done by DG CLIMA of the European Commission on behalf of the EU using the final EEA report.

1.3 Brief general description of methodologies and data sources used

As mentioned above, the EU GHG inventory is based on the inventories of its MS. They are responsible for the methods, emission factors and emissions used, and for the implementation of the reporting guidelines (MPGs) and the 2006 IPCC Guidelines, taking into account inventory priorities and resource constraints.

Member States use different national methodologies, national activity data or country-specific emission factors in accordance with the IPCC and the MPGs, and these are reflected in the EU GHG inventory. The EU believes, and the review process has confirmed, that it is consistent with Decision 18.CMA.1 of the Enhanced Transparency Framework under the Paris Agreement to use different methodologies for the same category across the EU as this reduces the uncertainty of emissions and removals, provided that the methodologies used are consistent with the 2006 IPCC Guidelines and its 2019 refinement.

In addition, according to the MPGs (Decision 18.CMA.1), each Party shall use methods from the 2006 IPCC guidelines and any subsequent version or refinement of the IPCC guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA). In Glasgow (Decision 5/CMA.3), Parties agreed to use the 2019 refinement on a voluntary basis. In addition, the MPGs say that each Party should make every effort to use a recommended method (tier level) for key categories in accordance with those IPCC guidelines.

The rationale for the methods used by Member States for EU key categories is consistent with the methodological choice and the Decision trees from the 2006 IPCC Guidelines and/or its 2019 refinement. Higher tier methods should be used for key categories, but the choice also needs to consider both inventory priorities and resources. This also implies that, even though Member States should make every effort to use a recommended method, tier 1 methods can still be used for key categories depending on national circumstances and prioritization, as well as on the availability of the activity data and other parameters required to perform the estimations.

The use of higher tier methods has increased over time in the EU inventory and remains a key element in the improvement of inventory quality, particularly its accuracy. Table 1.4 gives an overview on the share of emissions for which higher tiers are used in the EU for all key categories for which this estimation was possible.

Table 1.4 Share of higher tier methodologies used on the total of each EU key categories (excluding LULUCF)

Source category gas	**share of higher Tier**
1.A.1.a. Public electricity and heat production: Gaseous Fuels (CO_2)	99.0 %
1.A.1.a. Public electricity and heat production: Liquid Fuels (CO_2)	95.3 %
1.A.1.a. Public electricity and heat production: Other Fuels (CO_2)	95.6 %
1.A.1.a. Public electricity and heat production: Peat (CO_2)	99.2 %
1.A.1.a. Public electricity and heat production: Solid Fuels (CO_2)	96.4 %
1.A.1.b. Petroleum refining: Gaseous Fuels (CO_2)	98.5%
1.A.1.b. Petroleum refining: Liquid Fuels (CO_2)	97.4 %
1.A.1.c. Manufacture of solid fuels and other energy industries: Gaseous Fuels (CO_2)	95.6 %
1.A.1.c. Manufacture of solid fuels and other energy industries: Solid Fuels (CO_2)	96.4 %
1.A.2.a. Iron and steel: Gaseous Fuels (CO_2)	99.77 %
1.A.2.a. Iron and steel: Liquid Fuels (CO_2)	99.00 %
1.A.2.a. Iron and steel: Solid Fuels (CO_2)	99.94 %
1.A.2.b. Non-ferrous metals: Gaseous Fuels (CO_2)	94.85 %
1.A.2.c. Chemicals: Gaseous Fuels (CO_2)	99.63 %
1.A.2.c. Chemicals: Liquid Fuels (CO_2)	88.41 %
1.A.2.c. Chemicals: Solid Fuels (CO_2)	99.96 %
1.A.2.d. Pulp, paper and print: Gaseous Fuels (CO_2)	92.61 %
1.A.2.d. Pulp, paper and print: Liquid Fuels (CO_2)	79.87 %
1.A.2.d. Pulp, paper and print: Solid Fuels (CO_2)	92.8 %
1.A.2.e. Food processing, beverages and tobacco: Gaseous Fuels (CO_2)	97.21 %
1.A.2.e. Food processing, beverages and tobacco: Liquid Fuels (CO_2)	79.86 %
1.A.2.e. Food processing, beverages and tobacco: Solid Fuels (CO_2)	98.7 %
1.A.2.f. Non-metallic minerals: Gaseous Fuels (CO_2)	98.85 %
1.A.2.f. Non-metallic minerals: Liquid Fuels (CO_2)	95.74 %
1.A.2.f. Non-metallic minerals: Other Fuels (CO_2)	68.37 %
1.A.2.f. Non-metallic minerals: Solid Fuels (CO_2)	96.75 %
1.A.2.g. Other: Gaseous Fuels (CO_2)	95.3 %
1.A.2.g. Other: Liquid Fuels (CO_2)	97.18 %
1.A.2.g. Other: Other Fuels (CO_2)	92.5 %
1.A.2.g. Other: Solid Fuels (CO_2)	99.56 %
1.A.3.a. Domestic aviation: Jet Kerosene (CO_2)	94.1 %
1.A.3.b. Road transportation: Diesel Oil (CO_2)	83 %
1.A.3.b. Road transportation: Diesel Oil (N_2O)	95.6 %

1.A.3.b. Road transportation: Gaseous Fuels (CO_2)	91.4 %
1.A.3.b. Road transportation: Gasoline (CH_4)	97.4 %
1.A.3.b. Road transportation: Gasoline (CO_2)	90 %
1.A.3.b. Road transportation: Liquefied Petroleum Gases (LPG) (CO_2)	99.8 %
1.A.3.b. Road transportation: Other Fuels (CO_2)	95%
1.A.3.c. Railways: Liquid Fuels (CO_2)	73.7 %
1.A.3.d. Domestic navigation: Gas/Diesel Oil (CO_2)	74.3 %
1.A.3.d. Domestic navigation: Residual Fuel Oil (CO_2)	65.7 %
1.A.4.a. Commercial/institutional: Gaseous Fuels (CO_2)	94%
1.A.4.a. Commercial/institutional: Liquid Fuels (CO_2)	80%
1.A.4.a. Commercial/institutional: Other Fuels (CO_2)	97%
1.A.4.a. Commercial/institutional: Solid Fuels (CO_2)	98%
1.A.4.b. Residential: Biomass (CH_4)	50%
1.A.4.b. Residential: Gaseous Fuels (CO_2)	94%
1.A.4.b. Residential: Liquid Fuels (CO_2)	83%
1.A.4.b. Residential: Solid Fuels (CH_4)	8%
1.A.4.b. Residential: Solid Fuels (CO_2)	98%
1.A.4.c. Agriculture/forestry/fishing: Gaseous Fuels (CO_2)	87%
1.A.4.c. Agriculture/forestry/fishing: Liquid Fuels (CO_2)	77%
1.A.4.c. Agriculture/forestry/fishing: Solid Fuels (CO_2)	97%
1.A.5.a Stationary: Solid Fuels (CO_2)	97%
1.A.5.b Mobile: Liquid Fuels (CO_2)	83%
1.B.1.a. Coal mining and handling: no classification (CH_4)	75 %
1.B.2.a. Oil: no classification (CH_4)	39%
1.B.2.a. Oil: no classification (CO_2)	86 %
1.B.2.b. Natural gas: no classification (CH_4)	69 %
2.A.1. Cement production: no classification (CO_2)	100 %
2.A.2. Lime production: no classification (CO_2)	99.96 %
2.A.4. Other process uses of carbonates: no classification (CO_2)	91.12 %
2.B.1. Ammonia production: no classification (CO_2)	98.9 %
2.B.10. Other: no classification (CO_2)	97.0 %
2.B.2. Nitric acid production: no classification (N_2O)	100 %
2.B.3. Adipic acid production: no classification (N_2O)	100 %
2.B.8. Petrochemical and carbon black production: no classification (CO_2)	93.1 %
2.B.9. Fluorochemical production: no classification (Unspecified mix of HFCs and PFCs)	100 %
2.C.1. Iron and steel production: no classification (CO_2)	100 %
2.C.3. Aluminium production: no classification (PFCs)	100 %
2.F.1. Refrigeration and air-conditioning: no classification (HFCs)	100 %
3.A. Enteric fermentation: no classification (CH_4)	100%
3.B. Manure management: no classification (CH_4)	100%
3.B. Manure management: no classification (N_2O)	98.1%
3.D.1. Direct N_2O emissions from managed soils: Direct N_2O Emissions From Managed Soils (N_2O)	87%
3.D.2. Indirect N_2O emissions from managed soils: no classification (N_2O)	63.9%
3.G.1. Limestone $CaCO_3$: no classification (CO_2)	0%
5.A.1. Managed waste disposal sites: no classification (CH_4)	100%
5.A.2. Unmanaged waste disposal sites: no classification (CH_4)	100%

5.D.1. Domestic wastewater: no classification (CH_4)	63%
5.D.1. Domestic wastewater: no classification (N_2O)	32%
5.D.2. Industrial wastewater: no classification (CH_4)	39%

1.3.1 Use of data from EU ETS for the purposes of the national GHG inventories in EU Member States

1.3.1.1 Overview

As in Annex V under the MMR, Annex XII under Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action (GOV REG) requires Member States to report EU ETS emissions per CRT categories and to comment the share of EU ETS emissions in CRT categories.

The EU ETS generates an EU-27 data set on verified installation-specific emissions for the sectors covered by the scheme. For 2023, the main activities, the number of entities and the verified emissions reported under the EU ETS are presented in Table 1.5

Table 1.5 Activities and emissions covered by the EU ETS in 2023 (for combined EU 27 Member States)

Main activity	Activity code	Number of entities	Verified emissions (Mt CO_2-eq.)
Combustion of fuels	**20**	**5 488**	**637.5**
Refining of mineral oil	21	109	103.8
Production of coke	22	15	5.0
Metal ore roasting or sintering	23	10	1.7
Production of pig iron or steel	24	187	94.2
Production or processing of ferrous metals	25	194	6.4
Production of primary aluminium	26	20	1.9
Production of secondary aluminium	27	25	1.1
Production or processing of non-ferrous metals	28	74	5.2
Production of cement clinker	29	211	94.8
Production of lime, or calcination of dolomite/magnesite	30	212	21.1
Manufacture of glass	31	298	15.2
Manufacture of ceramics	32	659	9.6
Manufacture of mineral wool	33	48	1.6
Production or processing of gypsum or plasterboard	34	35	0.9
Production of pulp	35	144	3.6
Production of paper or cardboard	36	472	14.4
Production of carbon black	37	17	1.4
Production of nitric acid	38	29	1.9
Production of adipic acid	39	3	0.1
Production of glyoxal and glyoxylic acid	40	-	-
Production of ammonia	41	19	12.2
Production of bulk chemicals	42	275	25.5
Production of hydrogen and synthesis gas	43	37	7.1
Production of soda ash and sodium bicarbonate	44	12	3.5
Capture of greenhouse gases under Directive 2009/31/EC	45	-	-
Transport of greenhouse gases under Directive 2009/31/EC	46	-	-
Other activity opted-in under Art. 24	99	182	0.8
All stationary installations		8 775	1 071

Source: EEA, 2025 (EU ETS data viewer, EU 27)

1.3.1.2 Mapping table between EU ETS activities and CRT categories

The table below indicates the mapping between the EU ETS activities and the IPCC/CRT categories, with supporting comments. Such table is based on the scope of the EU ETS in the fourth phase and the CRT categories based on the revised UNFCCC reporting guidelines (decision 24/CP.19) that implemented the 2006 IPCC Guidelines.

The legal framework defining the scope and the methodologies for the reporting of greenhouse gas emissions under the EU ETS presents differences compared to the 2006 IPCC guidelines. These differences lead to a different way of reporting emissions under the EU ETS and in the GHG inventory. Some of these differences may also prevent inventory compilers from using verified emissions reported under the EU ETS directly for emission reporting in the national GHG inventory. In order to use greenhouse gas emissions reported under the EU ETS in the national inventories, the inventory compilers need to deal with these differences.

Table 1.6 Mapping table outlining the correspondence of CRT categories related to the EU ETS activities

EU ETS activity	CRT category	Comment
20 Combustion of fuels	1.A.1.a Public electricity and heat production 1.A.1.b Petroleum refining 1.A.2.a Iron and steel 1.A.2.b Non-ferrous metals 1.A.2.c Chemicals 1.A.2.d Pulp, paper and print 1.A.2.e Food processing, beverages and tobacco 1.A.2.f Non-metallic minerals 1.A.2.g Other 1.A.3.e Other transportation (pipeline transport) 1.A.4.a Commercial/ Institutional 1.A.4.c Agriculture/ Forestry / Fisheries 1.B Fugitive emissions from fuels	• For standalone combustion installations, EU ETS covers combustion of fuels in installation with a total rated thermal input exceeding 20 MW. For GHG inventories no such threshold applies. • In the GHG inventory, emissions are classified based on the purpose of the combustion activity, while such a differentiation does not exist in the definition of EU ETS activities. • Installations for the incineration of hazardous or municipal waste are excluded in the definition of 'combustion activities' under the EU ETS but included in GHG inventories. Installations used for research, development and testing of new products and processes are also not covered by the ETS Directive according to Annex I paragraph 1. • In the EU ETS an installation with different types of activities is classified according to the activity with predominant emissions, while in the inventory such activities should be reported in separate categories if so defined. This difference mostly applies in cases of large integrated installations. • Usually, a very small share of EU ETS emission from fuel combustion falls in the category of 1.A.4.a Commercial/ Institutional and 1.a.4.c Agriculture/ Forestry/ Fisheries as installations in these sectors mostly are below the EU ETS threshold.
21 Refining of mineral oil	1.A.1.b Petroleum refining 1.A.1.c Manufacture of solid fuels and other energy industries 1.A.2.c Chemicals 1.B.2.c Venting and flaring 1.B.2.a.iv Fugitive emissions from oil refining/ storage 2.B.8 Petrochemical and carbon black production 2.B.10 Other	EU ETS activity covers CO_2 emissions from combustion and also fugitive and process emissions. Emission sources reported under these activities are allocated to different CRT categories in the inventory: • Combustion emissions →1.A.1.b Petroleum refining • Flaring emissions → 1.B.2.c Venting and flaring • Refining → 1.B.2.a.iv Oil Refining/ storage • Hydrogen production → may be reported in 1.B.2.a.iv refining/ storage or in 2.B.10 Other chemical industry • Coke production / calcination → 1.A.1.c.i Manufacture of solid fuels • Flue gas scrubbing → 1.A.1.b Petroleum refining • Gasification of heavy fuel oil, methanol production → 2.B.8 Petro-chemical and carbon black production • Production of terephtalic acid → 2.B.10 Other chemical industry • Claus plants → 1.A.1.b Petroleum refining
22 Production of coke	1.A.1.c Manufacture of solid fuels and other energy industries	• Scopes of EU ETS and 2006 IPCC Guidelines are generally consistent, however EU ETS emissions may be

EU ETS activity	CRT category	Comment
	1.B Fugitive emissions 1.A.2 Manufacturing Industries 2.C.1 Iron and Steel	allocated to several CRT categories in the inventory. • The use of mass balance approaches in integrated iron and steel installations may complicate allocation between iron and steel categories and coke production.
23 Metal ore roasting or sintering, including palletisation	1.A.2.a Iron and steel 2.C.1 Iron and steel production 2.C.5 Lead production 2.C.6 Zinc production 2.C.7 Other metal production	• No clear separate category for this EU ETS activity in the inventory, allocation depends on the metal type. • Combustion emissions should be allocated to 1.A.2.a Iron and steel. • Process emissions should be allocated to 2.C.1 Iron and steel production or other metal production categories under industrial processes.
24 Production of pig iron or steel including continuous casting	1.A.2.a Iron and steel 2.C.1 Iron and steel production 1.B Fugitive emissions 1.A.1.c Manufacture of solid fuels and other energy industries	• Emissions are included in EU ETS only for those pig iron or steel installations with a capacity exceeding a threshold of 2.5 tonnes per hour while in GHG inventories there is no threshold. • EU ETS activity includes combustion and process emissions. • Combustion emissions should be allocated to 1.A.2.a Iron and steel. • Process emissions should be allocated to 2.C.1 Iron and steel production. • Emissions from coke production should be allocated to 1.A.1.c Manufacture of solid fuels and other energy industries. • Clear separation of combustion and process emissions is not always possible when mass balance approaches are used. • Comparability of emissions is influenced by the allocation of the transfer of CO_2 in the process gases (coke oven gas, blast furnace gas, basic oxygen furnace gas) to EU ETS activities as well as to CRT categories. Article 48 of the EU ETS MRR specifies the allocation of inherent CO_2 which results from an EU ETS activity and is contained in a gas which transferred to other installations as a fuel. If transfers of inherent CO_2 take place between EU ETS installations, the CO_2 transferred should not be counted as emissions for the installation of origin, but for the installation where it is finally emitted. However, if the transfer occurs to an installation outside the EU ETS scope, the transferring installation has to account for the emissions.
25 Production or processing of ferrous metals	1.A.2.a Iron and steel 2.C.1. Iron and steel production 2.C.2 Ferroalloys production 1.A.1.c Manufacture of solid fuels and other energy industries	• Emissions are included in EU ETS only for those ferroalloy production installations exceeding rated thermal input of 20 MW while in GHG inventories there is no threshold. • EU ETS scope of activity 25 covers CO_2 emissions related to the production or processing of ferrous metals from: o conventional and alternative fuels, o reducing agents including coke, o graphite electrodes, o raw materials including limestone and dolomite, o carbon containing metal ores and concentrates, o secondary feed materials. • Combustion related emissions from EU ETS activity code 25 are included in in CRT 1.A.2.a. Iron and Steel. • Process related emissions can be included in CRT 2.C.1 Iron and steel production or 2.C.2. Ferroalloys Production.
26 Production of primary aluminium	2.C.3 Aluminium production 1.A.2.b Non-ferrous metals	• In EU ETS operators shall report emissions from the production of electrodes for primary aluminium smelting, including stand-alone-installations for the production of such electrodes. The operator shall consider CO_2 emissions from: fuels for the production of heat or steam, electrode production, reduction of Al_2O_3 during electrolysis which is related to electrode consumption, use of soda ash or other carbonates for waste gas scrubbing. • For PFC emissions resulting from anode effects the scope of the EU ETS activity and CRT category 2.C.3 are consistent. PFC emissions are allocated to 2.C.3 Aluminium production. • CRT category 1.A.2.b Non-ferrous metals includes combustion emission and emission from waste gas

EU ETS activity	CRT category	Comment
		scrubbing. • Emissions from electrode consumption in EU ETS activity code 26 are included in CRT 2.C.3 Aluminium Production.
27 Production of secondary aluminium	1.A.2.b Non-ferrous metals	• Emissions are included in EU ETS only for installations exceeding rated thermal input of 20 MW while in GHG inventories there is no threshold. • In secondary aluminium production no process emissions occur therefore all emissions in activity code 27 are from fuel combustion and are reported in CRT category 1.A.2.b Non-ferrous metals.
28 Production or processing of non-ferrous metals	1.A.2.b Non-ferrous metals 2.C.4 Magnesium production 2.C.5 Lead production 2.C.6 Zinc production 2.C.7 Other metal production	• Emissions are included in EU ETS only for non-ferrous metals production or processing installations exceeding rated thermal input of 20 MW (including reducing agents) while in GHG inventories there is no threshold. • EU ETS activity includes combustion and process emissions. • Process related emissions from EU ETS activity code 28 are included in CRT 2.C.4 Magnesium Production, 2.C.5 Lead production, 2.C.6 Zinc Production and 2.C.7 Other metal industry. • 2006 IPCC Guidelines do not provide methodologies for metals other than iron and steel, ferroalloys, aluminium, magnesium, lead and zinc while the EU ETS has a broader scope and covers, e.g. copper production.
29 Production of cement clinker in rotary kilns	2.A.1 Cement Production 1.A.2.f Non-metallic minerals	• Emissions are included in EU ETS only for installations with production capacity exceeding 500 tonnes per day or in other furnaces with capacity exceeding 50 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • Process related emissions from EU ETS activity code 29 are included in CRT 2.A.1 Cement Production • Combustion related emissions from ETS activity code 29 are included in CRT 1.A.2.f. Non-metallic minerals
30 Production of lime, or calcination of dolomite/magnesite in rotary kilns or in other furnaces	2.A.2 Lime production 1.A.2.f Non-metallic minerals	• Emissions are included in EU ETS only for installations with production capacity exceeding 50 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • Process related emissions from EU ETS activity code 30 are included in CRT 2.A.2 Lime Production • Combustion related emissions from EU ETS activity code 30 are included in CRT 1.A.2.f. Non-metallic minerals. • Non-marketed lime production in some industries such as iron and steel or sugar refining are included in the inventory in category 2.A.2, but may be included in the EU ETS in the dominant activity, e.g. iron and steel industry or fuel combustion.
31 Manufacture of glass including glass fibre	2.A.3 Glass production 1.A.2.f Non-metallic minerals	• Emissions are included in EU ETS only for installations with a melting capacity exceeding 20 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • Process related emissions from EU ETS activity code 31 are included in CRT 2.A.3 Glass Production • Combustion related emissions from EU ETS activity code 31 are included in CRT 1.A.2.f. Non-metallic minerals
32 Manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain	2.A.4 Other process uses of carbonates 1.A.2.f Non-metallic minerals	• Emissions are included in EU ETS only for installations with a production capacity exceeding 75 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • Process related emissions from EU ETS activity code 32 are included in CRT 2.A.4 Other process uses of carbonates. • Combustion related emissions from EU ETS activity code 32 are included in CRT 1.A.2.f. Non-metallic minerals. • EU ETS method A is based on carbonate input and is

EU ETS activity	CRT category	Comment
		equivalent to IPCC tier 1 to 3 methods. EU ETS method B based on the alkali oxide output in the product has no equivalent method in the 2006 IPCC Guidelines. IPCC Guidelines also do not provide methods to estimate emissions from additives.
33 Manufacture of mineral wool insulation material using glass, rock or slag	2.A.3 Glass production 2.A.4 Other process uses of carbonates 2.A.5 Other 1.A.2.f Non-metallic minerals	• Emissions are included in EU ETS only for installations with a melting capacity exceeding 20 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • 2.A.3 Glass Production includes emissions from the production of glass wool, a category of mineral wool, where the production process is similar to glass making. Where the production of rock wool is emissive these emissions should be reported under IPCC Subcategory 2.A.5.
34 Drying or calcination of gypsum or production of plaster boards and other gypsum products	1.A.2.f Non-metallic minerals	• EU ETS covers CO_2 emissions from this activity, where combustion units have a total rated thermal input exceeding 20 MW. For GHG inventories no such threshold applies. • EU ETS activity only includes combustion-related emissions.
35 Production of pulp from timber or other fibrous materials	1.A.2.d Pulp, paper and print 2.A.4 Other process uses of carbonates (soda ash use)	• EU ETS activity includes combustion and process emissions. • Combustion related emissions from EU ETS activity code 35 are included in CRT 1.A.2.d. • Process related emissions are included in 2.A.4. Other process uses of carbonates.
36 Production of paper or cardboard	1.A.2.d Pulp, paper and print 2.A.4 Other process uses of carbonates (soda ash use)	• EU ETS activity includes combustion and process emissions. • Threshold in EU ETS: installations involved in the production of paper or cardboard a production capacity exceeding 20 tonnes per day. Inventory methodology has no threshold. • Combustion related emissions from EU ETS activity code 36 are included in CRT 1.A.2.d. • Process related emissions are included in 2.A.4 Other process uses of carbonates.
37 Production of carbon black involving the carbonisation of organic substances such as oils, tars, cracker and distillation residues	2.B.8 Petrochemical and carbon black production 1.A.2.c Chemicals	• EU ETS covers CO_2 emissions from this activity, where combustion units have a total rated thermal input exceeding 20 MW. For GHG inventories no such threshold applies. • EU ETS activity includes combustion and process emissions.
38 Production of nitric acid	2.B.2. Nitric acid production 1.A.2.c Chemicals	• Scopes of EU ETS and 2006 IPCC Guidelines for CO_2 emissions from nitric acid production are consistent. • EU ETS activity includes combustion and process emissions. • For EU ETS activity 38 all N_2O emissions are process-related and should be allocated to 2.B.2 Nitric acid production. • CO_2 emissions in activity code 38 are from fuel combustion and should be allocated to 1.A.2.c Chemicals.
39 Production of adipic acid	2.B.3. Adipic acid production (CO_2) 1.A.2.c Chemicals	• Scopes of EU ETS and 2006 IPCC Guidelines for CO_2 emissions from Adipic Acid production are consistent. • EU ETS activity includes combustion and process emissions. • For EU ETS activity 39 all N_2O emissions are process-related and should be allocated to CRT code 2.B.3 Adipic Acid Production. • CO_2 emissions in activity code 38 are from fuel combustion and should be allocated to 1.A.2.c Chemicals .
40 Production of glyoxal and glyoxylic acid	2.B.4. Caprolactam, glyoxal and glyoxylic acid production 1.A.2.c Chemicals	• Scopes of EU ETS and 2006 IPCC Guidelines for N_2O emissions from glyoxal production and glyoxylic acid production are consistent. • EU ETS activity includes combustion and process emissions.

EU ETS activity	CRT category	Comment
		• N_2O emissions should be allocated to CRT code 2.B.4 Caprolactam, glyoxal and glyoxylic acid production. • CO_2 emissions in activity code 40 are from fuel combustion and should be allocated to 1.A.2.c Chemicals

41 Production of ammonia	2.B.1. Ammonia production
	CO_2 captured for urea production:
	3.H Urea Application
	1.A.3.b Road transport
	2.D.3 Other non-energy products from fuels and solvent use
		• EU ETS scope of activity code 41 ammonia production includes:
		  • combustion of fuels supplying the heat for reforming or partial oxidation,
		  • fuels used as process input in the ammonia production process (reforming or partial oxidation),
		  • fuels used for other combustion processes including for the purpose of producing hot water or steam.
		• According to 2006 IPCC Guidelines to avoid double counting, fuel consumption in ammonia production should be reported under Ammonia production. In this regard EU ETS and IPCC scopes are consistent.
		• In the inventory CO_2 from ammonia production which is recovered and used for urea production is subtracted and reported by the users. Urea use can be reported in different CRT sectors, e.g. in 1.A.3.b Road transport, 3.H Urea application in agriculture, 2.D.3 Other (e.g. in industry catalysts). Under the EU ETS the CO_2 transfer via urea out of the EU ETS system cannot be deducted from ammonia production for EU ETS reporting.

42 Production of bulk organic chemicals by cracking, reforming, partial or full oxidation or by similar processes	2.B.8 Petrochemical and carbon black production 2.B.10 Other chemical industry 1.A.2.c Chemicals	• Emissions are included in EU ETS only for installations with a production capacity exceeding 100 tonnes per day. Inventory methodology has no threshold. • EU ETS activity includes combustion and process emissions. • The combustion related emissions are allocated to CRT code 1.A.2.c Chemicals. • Some of the emissions reported under this EU ETS activity could be allocated to CRT category 2.B.8 Petrochemical and carbon black production (e.g. CO_2 process emissions). • Some of the emissions reported under this EU ETS activity could be allocated to CRT category 2.B.10 Other chemical industry (e.g. CO_2 emissions from flaring in chemical industry).
43 Production of hydrogen and synthesis gas by reforming or partial oxidation	1.A.2.c Chemicals 2.B.1. Ammonia production 2.B.8 Petrochemical and carbon black production 2.B.10 Other chemical industry 1.B.2.a.iv Fugitive emissions from oil refining/ storage	• Emissions are included in EU ETS only for installations with a production capacity exceeding 25 tonnes per day. IPCC methodology has no threshold. • EU ETS activity includes combustion and process emissions. • In the CRT, there is no separate reporting category for emissions from hydrogen production. Hydrogen and synthesis gas production are recognised as part of integrated chemical production. Therefore, MS have chosen different approaches for the inclusion of emissions from hydrogen production (e.g. 2.B.8 or 2.B.10). • Some emissions may also be reported under CRT category 1.B.2.a.iv Fugitive emissions from oil subcategory refining/ storage.
44 Production of soda ash and sodium bicarbonate	1.A.2.c Chemicals 2.B.7 Soda ash production	• EU ETS activity includes combustion and process emissions. • Combustion related emissions from EU ETS activity code 44 for production are included in CRT 1.A.2.c Chemicals. • Process related emissions are included in 2.B.7. Soda Ash Production
45 Capture of greenhouse gases under Directive 2009/31/EC	Capture of emissions would be reported under the respective inventory sector e.g. 1.A.1.a Public electricity and heat production.	• Consistent with scope and methodologies of inventory.
46 Transport of greenhouse gases by pipelines for geological storage in a storage site	1.C.1 Transport of CO_2	• Consistent with scope and methodologies of inventory

EU ETS activity	CRT category	Comment
permitted under Directive 2009/31/EC		
47 Geological storage of greenhouse gases in a storage site permitted under Directive 2009/31/EC	1.C.2 Injection and storage	• Consistent with scope of inventory (currently no emissions reported under the EU ETS)
99 Other activity opted-in under Art. 24 of the ETS Directive	Depending on type of activity opted-in	Article 24 allows the unilateral inclusion of additional activities and gases under the EU ETS. These activities and gases are not allocated to a specific activity, but under a separate activity code.

In the GHG inventory, the emissions are reported per CRT categories (Annex V under the MMR (phase III of EU ETS); Annex XII under the GOV REG for phase IV). In the EU ETS a single installation can include several ETS activities as defined in Annex I of the EU ETS Directive. In the EU ETS emissions are attributed to a specific installation, independently from the Annex I activities covered. Nevertheless, the operator must report detailed information for each source stream of the installation, and include activities classification as per Annex I, in his annual report to the competent authorities. The different approaches can lead to differences in reported emissions if ETS activities and inventory categories are compared directly.

Scope of activities and installation boundaries

The EU ETS cover installations with activities overpassing certain capacity thresholds (which can sometimes be null). Hence, the inventory scopes for the same activities are often larger (or equal).

Determination of tiers

IPCC guidelines are based on methodological tiers that require higher tier levels of accuracy for emission sources contributing to a significant extent to the total emissions in a country.

In the EU ETS, tiers apply at installation level for each source stream activity data and calculation factors and are defined in legislation on the basis of the installation emissions (thresholds are < 50 kt, ≥ 50 kt and ≤ 500 kt and > 500 kt CO_2eq) and source stream contributions. EU ETS verified emissions, if aggregated at sectoral level, may include contributions from small, medium and large emitters and are therefore based on different EU ETS tiers.

The mapping table above shows that a direct comparison between verified emissions from EU ETS activities and emissions reported in CRT categories is not straightforward.

An analysis of data consistency between EU ETS and inventory data ideally requires: (1) an assessment of the assignment of the detailed data reported by each individual EU ETS installation to national competent authorities with respect to the CRT categories; (2) a detailed comparison of the methodological parameters (methods, activity data, calculation parameters).

1.3.1.3 Use of EU ETS data reported in 2024

Under the GOV REG article 37 (EU 2018a), Member States are required to perform consistency checks between the emissions reported in the GHG inventories and the verified emissions reported under the EU ETS Directive. The installation-specific emissions data reported by operators under the EU ETS can be used in different ways for the purposes of the national GHG inventories:

1. Reported verified emissions can be directly used in the GHG inventory to report CO_2 emissions for a specific source category. This requires a number of careful checks, e.g. whether the coverage of the respective EU ETS emissions is complete for the respective source category and that EU ETS activities and CRT source categories follow the same definitions. If EU ETS

emissions are not complete, the emissions for the remaining part of the source category not covered by the EU ETS have to be calculated separately and added to the EU ETS emissions.

2. Emission factors (or other parameters such as oxidation factors) reported under the EU ETS can be compared with emission factors used in the inventory and the latter can be harmonised if the EU ETS provides improved information.
3. Activity data reported under the EU ETS can be used directly for the GHG inventory, in particular for source categories where energy statistics face difficulties in disaggregating fuel consumption to specific subcategories, e.g. to specific industrial sectors or for specific non-marketed fuels.
4. Data from EU ETS can be used for more general verification activities as part of national quality assurance (QA) activities without the direct use of emissions, activity data or emission factors.
5. Data from EU ETS can improve completeness of the estimation of IPCC source categories when additional data for sub-categories become available from EU ETS.
6. EU ETS data can improve the allocation of industrial combustion emissions to sub-categories under 1.A.2 Manufacturing Industries and Construction.
7. The comparison of the data sets can be used to improve the uncertainty estimation for the GHG inventories based on the uncertainties of data reported by installations.

Based on the information submitted in the national inventory reports (NIDs) in 2024 to the European Commission, all Member States indicated that they used EU ETS data at least for QA/QC purposes (Table 1.7). 24 Member States indicated to directly use the verified emissions reported by installations under the EU ETS (depending on the sectors). All Member States used EU ETS data to improve country-specific emission factors. And all Member States reported that they used activity data (e.g. fuel use) provided under the EU ETS in the national inventory (depending of the sectors).

Table 1.7 Use of EU ETS data for the purposes of the national GHG inventory

Member State	Use of emissions	Use of Activity data	Use of emission factors	Use for quality assurance
Austria	✓	✓	✓	✓
Belgium	✓	✓	✓	✓
Bulgaria	✓	✓	✓	✓
Croatia	✓	✓	✓	✓
Cyprus	✓	✓	✓	✓
Czech Republic	✓	✓	✓	✓
Denmark	✓	✓	✓	✓
Estonia		✓	✓	✓
France	✓	✓	✓	✓
Finland	✓	✓	✓	✓
Germany	✓	✓	✓	✓
Greece	✓	✓	✓	✓
Hungary	✓	✓	✓	✓
Ireland	✓	✓	✓	✓
Italy	✓	✓	✓	✓
Latvia	✓	✓	✓	✓
Lithuania	✓	✓	✓	✓
Luxembourg	✓	✓	✓	✓
Malta	✓	✓	✓	✓
Netherlands	✓	✓	✓	✓
Poland	✓	✓	✓	✓
Portugal	✓	✓	✓	✓
Romania	✓	✓	✓	✓
Slovakia		✓	✓	✓
Slovenia		✓	✓	✓
Spain	✓	✓	✓	✓
Sweden	✓	✓	✓	✓

Source: Member States NID 2025

1.3.2 Cooperation with EUROCONTROL

At the end of 2010 the European Commission signed a framework contract with EUROCONTROL, the European organization for the safety of air navigation, regarding 'the support to the European Commission in relation to climate change policy and the implementation of the EU ETS'. This support project is organized in different Work Packages (WP) corresponding to the different areas identified in the framework contract and has been regularly continued.

One of these Work Packages pertains to the improvement of GHG and air pollutant emissions inventories submitted by the 27 Member States and the European Union to the UNFCCC and to the UNECE. The main objective of the WP is to assist EU Member States improve the reporting of annual greenhouse gas (and other air pollutant) emission inventories by e.g., estimating the fuel split domestic/international using real flight data from EUROCONTROL. The European Environment Agency and its ETC/CM assist DG CLIMA regarding the technical requirements.

To support the inventory process for the submission in 2025, in August/September 2024 Member States received fuel and emissions data for the years 2005 to 2023 as calculated by EUROCONTROL using a TIER 3b methodology applying the Advanced Emissions Model (AEM). This is a follow up of ERT recommendations made to perform QA exercises and to make data from EUROCONTROL available to Member States on a regular basis.

In the course of the 'initial checks' of MS inventories in the first months of 2025 the comparison between Tier 3b calculations from EUROCONTROL and time series of MS inventories has been conducted. In case of considerable differences between Member State results and those from EUROCONTROL, the European Environment Agency and its ETC/CM asked Member States via the EMRT about possible reasons. In addition, the European Environment Agency provided MS with a comparison between EUROCONTROL data and MS data on fuel consumption of civil and international aviation for the years 2015 and 2023, related emissions and implied emission factors for CO_2, CH_4 and N_2O.

Eurostat energy data

During the initial checks carried out before the compilation of the EU GHG inventory, Eurostat energy data is used for cross checking the sectoral and reference approach of the MS submissions. This check is an important QA/QC element of the EU GHG inventory compilation.

In general, the quality of the EU GHG inventory is directly affected by the quality of Member States and EU energy statistics collected by Eurostat on the basis of the relevant regulation[17]. The energy statistics regulation was adopted as part of the energy package and establishes a common framework for the production, transmission, evaluation and dissemination of comparable energy statistics in the EU. This regulation aims at collecting detailed statistical data on energy flows by energy commodity on an annual and monthly basis. It ensures harmonised and coherent reporting of national energy data, which is necessary for the assessment of EU related policies and targets.

The energy statistics regulation helps improving the QA/QC of the EU inventory as it:

- makes available more detailed energy statistics by fuel;
- allows the estimation of CO_2 emissions from energy with the reference and sectoral approach;
- assures the quality of the underlying energy statistics;
- improves timeliness of energy statistics;
- provides a formal legal framework assuring consistency between national and Eurostat data.

Moreover, Article 6, paragraph 2 stipulates that:

"Every reasonable effort shall be undertaken to ensure coherence between energy data declared in the energy statistics regulation, and data declared in accordance with Commission Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol."

In addition, Annex V of the Governance Regulation in conjunction with Article 17 of the Commission Implementing Regulation 2020/1208 requires Member States to report to the European Commission textual information on the comparison between the reference approach calculated on the basis of the data included in the greenhouse gas inventory and the reference approach calculated on the basis of

[17] REGULATION (EC) No 1099/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2008 on energy statistics as amended by Commission Regulation (EU) No 147/2013 of 13 February 2013.

the data reported pursuant to the Energy Statistics Regulation. Member States with differences of more than ± 2% in the total national apparent fossil fuel consumption have to provide quantitative information and explanations for the year X-2 in accordance with the tabular format set out in Annex XIV of the Commission Implementing Regulation.

1.4 Description of key categories

A key category analysis has been carried out according to the Tier 1 method (quantitative approach) described in the 2006 IPCC guidelines. A key category is defined as an emission source that has a significant influence on a country's GHG inventory in terms of the absolute level of emissions, the trend in emissions, or both.

In addition to the key category analysis at Union level, every Member State provides a national key category analysis which is independent from the assessment at Union level. The Union key category analysis is not intended to replace the key category analysis by Member States. The key category analysis at Union level is carried out to identify those categories for which overviews of Member States' methodologies, emission factors, quality estimates and emission trends are provided in this report. In addition, the Union key category analysis helps identifying those categories that should receive special attention with regard to QA/QC at EU level. The Member States use their key category analysis for improving the quality of emission estimates at Member State level.

To identify key categories of the EU the following procedure was applied:

- Starting point for the key category identification for this report was the EEA database. All categories where GHG emissions/removals occur were listed, at an aggregation level such as 2.B.1 and split by gas, while for the sector Energy a less aggregated level such as 1.A.1.a, split by fuel and per gas was chosen. It makes sense for the EU to rely on this less aggregated level for the KCA as also the initial checks of the MS submissions are performed at this level of detail and therefore guarantee a more profound quality checking for all EU key categories (at fuel level). Additionally, the EU KCA (at detailed level) is used in order to select the categories for which more detailed information is provided in the EU NID. Although the more detailed EU approach differs from the KCA generated in the CRT overall the results are very similar.
- The confidential data of Sweden were not included when the key category analysis was conducted owing to timing constraints. The list of (sub-) categories for which confidential data reported by member States are excluded when conducting the key category analysis is included in chapter 1.7.3. The exclusion of confidential Swedish data does not significantly affect the EU key category analysis as these emissions for 2023 account for roughly 1000 kt CO_2 equivalents whereas the smallest EU key category is 4548 kt CO_2 equivalents.
- A level and a trend assessment was carried out for the years 1990 and 2023. The assessment was carried out for emissions excluding LULUCF and including LULUCF.
  The key category analysis including LULUCF identified 94 key categories for the EU covering 95.1 % of total EU GHG emissions in 2023 (Table 1.8). The key category analysis excluding LULUCF resulted in 79 key categories (Annex I).

In Chapters 3 to 7 overview tables are presented for each EU key category showing the Member States' contributions to the EU key category in terms of level and trend.

Table 1.8 Key categories for the EU (Gg CO_2 equivalents)

Source category (gas)	kt CO_2 equ.		Trend	Level	
	1990	2023		1990	2023
1.A.1.a. Public electricity and heat production: Gaseous Fuels (CO_2)	107649	162489	T	L	L
1.A.1.a. Public electricity and heat production: Liquid Fuels (CO_2)	156323	22537	T	L	L
1.A.1.a. Public electricity and heat production: Other Fuels (CO_2)	10453	36123	T	L	L
1.A.1.a. Public electricity and heat production: Peat (CO_2)	9164	2560	T	L	0
1.A.1.a. Public electricity and heat production: Solid Fuels (CO_2)	942629	344275	T	L	L
1.A.1.b. Petroleum refining: Gaseous Fuels (CO_2)	5345	15411	T	0	L
1.A.1.b. Petroleum refining: Liquid Fuels (CO_2)	97131	77001	T	L	L
1.A.1.c. Manufacture of solid fuels and other energy industries: Gaseous Fuels (CO_2)	8199	7218	0	L	L
1.A.1.c. Manufacture of solid fuels and other energy industries: Solid Fuels (CO_2)	88816	19266	T	L	L
1.A.2.a. Iron and steel: Gaseous Fuels (CO_2)	29392	15078	T	L	L
1.A.2.a. Iron and steel: Liquid Fuels (CO_2)	9044	943	T	L	0
1.A.2.a. Iron and steel: Solid Fuels (CO_2)	112372	51561	T	L	L
1.A.2.b. Non-ferrous metals: Gaseous Fuels (CO_2)	3013	5668	T	0	L
1.A.2.c. Chemicals: Gaseous Fuels (CO_2)	49415	28918	0	L	L
1.A.2.c. Chemicals: Liquid Fuels (CO_2)	29757	9981	T	L	L
1.A.2.c. Chemicals: Solid Fuels (CO_2)	11978	7252	0	L	L
1.A.2.d. Pulp, paper and print: Gaseous Fuels (CO_2)	11336	13029	T	L	L
1.A.2.d. Pulp, paper and print: Liquid Fuels (CO_2)	10835	1340	T	L	0
1.A.2.d. Pulp, paper and print: Solid Fuels (CO_2)	6761	1033	T	0	0
1.A.2.e. Food processing, beverages and tobacco: Gaseous Fuels (CO_2)	15813	25992	T	L	L
1.A.2.e. Food processing, beverages and tobacco: Liquid Fuels (CO_2)	18064	2948	T	L	0
1.A.2.e. Food processing, beverages and tobacco: Solid Fuels (CO_2)	11557	2820	T	L	0
1.A.2.f. Non-metallic minerals: Gaseous Fuels (CO_2)	27265	27786	T	L	L
1.A.2.f. Non-metallic minerals: Liquid Fuels (CO_2)	46179	19657	T	L	L
1.A.2.f. Non-metallic minerals: Other Fuels (CO_2)	1438	13259	T	0	L
1.A.2.f. Non-metallic minerals: Solid Fuels (CO_2)	52351	10177	T	L	L
1.A.2.g. Other: Gaseous Fuels (CO_2)	79964	67434	T	L	L
1.A.2.g. Other: Liquid Fuels (CO_2)	81677	34765	T	L	L
1.A.2.g. Other: Other Fuels (CO_2)	2451	4576	T	0	L
1.A.2.g. Other: Solid Fuels (CO_2)	90603	7532	T	L	L
1.A.3.a. Domestic aviation: Jet Kerosene (CO_2)	10822	12937	T	L	L
1.A.3.b. Road transportation: Diesel Oil (CO_2)	270666	517316	T	L	L
1.A.3.b. Road transportation: Diesel Oil (N_2O)	1336	5725	T	0	L
1.A.3.b. Road transportation: Gaseous Fuels (CO_2)	508	4110	T	0	0
1.A.3.b. Road transportation: Gasoline (CH_4)	5563	678	T	0	0
1.A.3.b. Road transportation: Gasoline (CO_2)	330722	209908	0	L	L
1.A.3.b. Road transportation: Liquefied Petroleum Gases (LPG) (CO_2)	7428	15103	T	L	L
1.A.3.b. Road transportation: Other Fuels (CO_2)	1	2592	T	0	0
1.A.3.c. Railways: Liquid Fuels (CO_2)	11549	3182	T	L	0
1.A.3.d. Domestic navigation: Gas/Diesel Oil (CO_2)	13286	9693	0	L	L
1.A.3.d. Domestic navigation: Residual Fuel Oil (CO_2)	7835	5101	0	L	L
1.A.4.a. Commercial/institutional: Gaseous Fuels (CO_2)	50377	72207	T	L	L

Source category (gas)	kt CO_2 equ.		Trend	Level	
	1990	2023		1990	2023
1.A.4.a. Commercial/institutional: Liquid Fuels (CO_2)	73123	20392	T	L	L
1.A.4.a. Commercial/institutional: Other Fuels (CO_2)	748	6169	T	0	L
1.A.4.a. Commercial/institutional: Solid Fuels (CO_2)	45123	1836	T	L	0
1.A.4.b. Residential: Biomass (CH_4)	10436	11375	T	L	L
1.A.4.b. Residential: Gaseous Fuels (CO_2)	129929	159508	T	L	L
1.A.4.b. Residential: Liquid Fuels (CO_2)	174109	70997	T	L	L
1.A.4.b. Residential: Solid Fuels (CH_4)	8905	1795	T	L	0
1.A.4.b. Residential: Solid Fuels (CO_2)	118831	20431	T	L	L
1.A.4.c. Agriculture/forestry/fishing: Gaseous Fuels (CO_2)	12287	10502	T	L	L
1.A.4.c. Agriculture/forestry/fishing: Liquid Fuels (CO_2)	65576	57137	T	L	L
1.A.4.c. Agriculture/forestry/fishing: Solid Fuels (CO_2)	9740	1896	T	L	0
1.A.5.a Stationary: Solid Fuels (CO_2)	6065	4	T	0	0
1.A.5.b Mobile: Liquid Fuels (CO_2)	8088	2722	0	L	0
1.B.1.a. Coal mining and handling: no classification (CH_4)	82199	21939	T	L	L
1.B.2.a. Oil: no classification (CH_4)	6993	728	T	0	0
1.B.2.a. Oil: no classification (CO_2)	8633	8941	T	L	L
1.B.2.b. Natural gas: no classification (CH_4)	47005	11275	T	L	L
2.A.1. Cement production: no classification (CO_2)	95237	61198	0	L	L
2.A.2. Lime production: no classification (CO_2)	23924	14275	0	L	L
2.A.4. Other process uses of carbonates: no classification (CO_2)	11068	7877	0	L	L
2.B.1. Ammonia production: no classification (CO_2)	31624	13813	T	L	L
2.B.10. Other: no classification (CO_2)	9169	13927	T	L	L
2.B.2. Nitric acid production: no classification (N_2O)	40776	1534	T	L	0
2.B.3. Adipic acid production: no classification (N_2O)	33558	66	T	L	0
2.B.8. Petrochemical and carbon black production: no classification (CO_2)	13603	12921	T	L	L
2.B.9. Fluorochemical production: no classification (Unspecified mix of HFCs and PFCs)	4787	25	T	0	0
2.C.1. Iron and steel production: no classification (CO_2)	103487	54394	T	L	L
2.C.3. Aluminium production: no classification (PFCs)	17234	132	T	L	0
2.F.1. Refrigeration and air-conditioning: no classification (HFCs)	5	51247	T	0	L
3.A. Enteric fermentation: no classification (CH_4)	240658	179484	T	L	L
3.B. Manure management: no classification (CH_4)	55973	44941	T	L	L
3.B. Manure management: no classification (N_2O)	27241	17643	0	L	L
3.D.1. Direct N_2O emissions from managed soils: Direct N_2O Emissions From Managed Soils (N_2O)	113209	86551	T	L	L
3.D.2. Indirect N_2O emissions from managed soils: no classification (N_2O)	33008	22366	0	L	L
3.G.1. Limestone $CaCO_3$: no classification (CO_2)	6702	4639	0	0	L
4(II).D. Emissions and removals from drainage and rewetting and other management of organic and mineral soils (CH_4)	8299	8576	T	L	L
4.A.1. Forest land remaining forest land: no classification (CO_2)	-324436	-223878	T	L	L
4.A.1. Forest land remaining forest land: no classification (N_2O)	4445	4548	0	0	L
4.A.2. Land converted to forest land: no classification (CO_2)	-54483	-57411	T	L	L
4.B.1. Cropland remaining cropland: no classification (CO_2)	33670	13393	T	L	L
4.B.2. Land converted to cropland: no classification (CO_2)	37446	18406	T	L	L
4.C.1. Grassland remaining grassland: no classification (CO_2)	44867	25190	T	L	L
4.C.2. Land converted to grassland: no classification (CO_2)	-8584	-16587	T	L	L

Source category (gas)	kt CO_2 equ.		Trend	Level	
	1990	2023		1990	2023
4.D.1. Wetlands remaining wetlands: no classification (CH_4)	8269	8374	T	L	L
4.D.1. Wetlands remaining wetlands: no classification (CO_2)	9801	9927	T	L	L
4.E.2. Land converted to settlements: no classification (CO_2)	20574	29709	T	L	L
4.E.2. Land converted to settlements: no classification (N_2O)	4065	1645	T	0	0
5.A.1. Managed waste disposal sites: no classification (CH_4)	102025	65327	0	L	L
5.A.2. Unmanaged waste disposal sites: no classification (CH_4)	30221	8554	T	L	L
5.D.1. Domestic wastewater: no classification (CH_4)	26758	10523	T	L	L
5.D.1. Domestic wastewater: no classification (N_2O)	6739	8774	T	0	L
5.D.2. Industrial wastewater: no classification (CH_4)	9601	5431	0	L	L

Note: EU totals for 2023 in sector Energy and IPPU do not include data for Sweden due to confidential reporting. For more details on confidential reporting from Sweden refer to section 1.7.2.

1.5 Quality assurance, quality control of the European Union inventory

1.5.1 QA/QC programme

The European Commission (Directorate General Climate Action) is responsible for coordinating QA/QC procedures for the EU inventory and ensures that the objectives of the QA/QC programme are implemented in the design of the QA/QC manual defining general and specific QC procedures for the EU GHG inventory submission. The European Environment Agency (EEA) is responsible for the annual implementation of these QA/QC procedures for the EU inventory.

In the EU QA/QC programme the general responsibilities for the QA/QC are defined as follows:

- The Member States are responsible for the quality of activity data, emission factors and other parameters used for their inventories, as well as for adherence to the IPCC methodologies. Member States are also responsible for establishing national QA/QC programmes for their inventories as part of their national inventory systems.
- The European Commission (DG CLIMA) ensures that the objectives of the QA/QC programme are fulfilled. The EEA is responsible for the annual implementation of QA/QC procedures for the Union inventory. The EEA performs the tasks relating to the objectives of the QA/QC programme while the EEA’s ETC/CM coordinates QA/QC activities for the Union inventory and develops the QA/QC plan.

A number of specific objectives have been elaborated in order to ensure that the EU GHG inventory complies with the UNFCCC inventory principles of transparency, completeness, consistency, comparability, accuracy and timeliness. The quality objectives are implemented via the QA/QC plan that, among others, aims at ensuring the consistency of the Union inventory with the sum of Member States inventories so that the inventory is complete in terms of both geographical and sectoral coverage. The QA/QC plan describes the quality control procedures that take place before the EU inventory compilation, for checking the consistency, completeness and correctness of the Member States inventories, as well as during the compilation of the EU GHG inventory, for ensuring the correctness of the EU data prior to its submission. In addition, QA procedures are defined, such as the Working Group1, an internal review mechanism, sector specific workshops, UNFCCC review results.

Based on the EU QA/QC programme a quality management manual was developed which includes all specific details of the QA/QC procedures (in particular checklists and forms). The structure of the EU quality management manual has been developed on the basis of the Austrian quality management manual. The reason for using the Austrian manual as a template for the EU manual is that the EU GHG inventory is compiled by Environment Agency Austria and the implementation of the annual QA/QC procedures are coordinated by Environment Agency Austria. By using the Austrian quality manual as a template for the EU quality manual the EU can benefit from the experience made during the set-up of the Austrian quality management system which fulfils the requirements of EN ISO/IEC 17020 (Type A); procedures and documents from the Austrian system have been taken and adapted according to the need of the EU quality management system.

The EU quality management manual is structured along three main processes (management processes, inventory compilation processes and supporting processes) of the quality management system (Table 1.9)

Table 1.9 Structure of the EU quality management manual

Chapter		Chapter description
Management processes		
ETC 01	EU inventory system	Describes the organisation and responsibilities within the EU GHG inventory system
ETC 02	QA/QC programme	Describes the preparation and evaluation of the EU QA/QC programme by the European Commission
ETC 03	Quality management system	Describes the responsibilities and the structure of the quality management system and gives an overview of the forms and checklists used
ETC 04	Quality management evaluation	Describes the evaluation of the status and effectiveness of the quality management system
ETC 05	Correction and prevention	Describes the procedures for the correction and prevention of mistakes that occur in the EU inventory
ETC 06	Information technology systems	Describes the information technology systems used such as CIRCA, Reportnet and the systems set up at Environment Agency Austria
ETC 07	External communication	Describes the communication with Member States and other persons and institutions
Inventory compilation processes		
ETC 08	QC MS submissions	Describes the quality control activities performed on the GHG inventories submitted by the EU Member States
ETC 09	QC EU inventory compilation	Describes the quality control activities performed during the compilation of the EU GHG inventory including checks of database integrity
ETC 10	QC EU inventory report	Describes the checks carried out during and after the compilation of the EU GHG inventory report
Supporting processes		
ETC 11	Documents	Describes the production, change, proofreading, release and archiving of quality management documents
ETC 12	Documentation and archiving	Describes the procedure for preparing documentation and archiving

The quality checks performed during inventory compilation process are the central part of the quality manual. Quality checks are made at three levels:

1.5.2 Quality control procedures at MS inventory level

The QC activities of MS submissions include:

Completeness Check	- all gases for all years
	- correct use of notation keys
	- check of blank cells
Time series consistency	- consistency in emissions, IEF - detect identical values in different reporting years
IEF comparison	- identify IEF outliers

Recalculations	- identify recalculations > +/- 0.05% and/or 500 kt CO_2 eq - check explanations provided - check recalculations of resubmissions within year
EU ETS	- check consistency/transparency of EU ETS data with CRT data
Review recommendations	- check status of implementation of review recommendations
Potential over- and underestimates	- identify potential over- and underestimates and MS level
Methods and EF used	- collect and check information on methods and EF used

For the communication with Member States and the documentation of the observations made by sector experts during the 'initial checks' phase the EEA Emission Review Tool (EMRT; https://emrt.eea.europa.eu/) is used. For this reason Member States nominations have been made to DG Climate Action and the EEA. The workflow in the tool allows the implementation of the 'four-eye' principle since the questions of the 'sectoral experts' are approved by the 'quality experts' team. Issues related to 'completeness', especially the ones that might need to be followed up by 'gap filling procedures' are also highlighted. All the issues identified in the EMRT are archived and can be accessed by the future EU sectoral and quality experts in the annual QA/QC procedures, to avoid repetition of questions on known issues.

According to the timeline provided above, the checks are performed between 15th January and 28th February.

On 28 February MS receive the EIONET/WG1 consultation package. In particular, Member States are asked to check:

1. the QA/QC findings flagged in the EMRT;
2. if the correct data/information has been included in the draft CRT tables/draft inventory report, including the information on methodologies and EFs used for the EU key categories (Annex III).

Both responses to the findings included in the EMRT and comments to the draft EU GHG inventory and inventory report are provided by latest 15 March to the EU inventory team. By that date Member States can resubmit their inventories, also correcting issues that came up during the initial checks. In order to follow up on significant issues, as provided for in the Governance Regulation, all the tools supporting the checks are re-produced and the findings in the EMRT are followed up. Between 15th March and 7th April follow-up questions and questions on new material received from MS may be asked in the EMRT.

Observations by the EU inventory team that are not resolved at the end of the QA/QC process in one submission year will be followed-up in the consecutive year.

1.5.3 Quality control at EU inventory level

After the initial checks of the emission data, the EEA transfers the national data from the JSON-files into their CRT CWS database. The CRT CWS database is maintained and managed by European Environment Agency. As the EU GHG inventory is compiled on the basis of the inventories of the EU Member States, the focus of the quality control checks performed during the compilation of the EU GHG inventory lays on checking if the correct MS data are used, if the data can be summed-up (same units are used) and that the summing-up is correct. Finally, the consistency and the completeness of the EU GHG inventory is checked. These checking procedures are performed by the EEA and the results are shared with the ETC/CM and are archived. Comments to these results are then provided and used as relevant for approving the inventory prior to its submission. All the checks are carried out for the original submission by 15 April each year and for any resubmission. Two checklists from the QA/QC manual are used for this purpose: 'Inventory preparation/consistency' and 'Data file integrity'.

1.5.4 Quality assurance procedures

The checks carried out during and after the compilation of the EU GHG inventory report, are specified in the checklist 'EU inventory report' as defined in the QA/QC manual. They cover e.g. checks of data consistency between the inventory and the inventory report, data consistency between the tables and the text, but also layout checks. Since 2014 the EU team has also been reinforced by 'quality control' experts who have the additional task of reviewing the content and the consistency between the CRF data and tables and the NID.

The circulation of the draft EU inventory and inventory report on 28 February to the EU Member States for reviewing and commenting also aims to improve the quality of the EU inventory and inventory report. The Member States check their national data and information used in the EU inventory report and send updates, if necessary, and review the EU inventory report. This procedure should assure the timely submission of the EU GHG inventory and inventory report to the UNFCCC secretariat and it should guarantee that the EU submission to the UNFCCC secretariat is consistent with the Member States UNFCCC submissions.

EU internal reviews (Reviews under the 'Effort Sharing Decision')

Between 2012 and 2022, nine EU internal inventory reviews have been carried out in order to determine the emission allocations 2013-2020 for the EU internal GHG emission reduction targets for 2020 and in order to determine compliance with the ESD targets (Effort Sharing Decision[18])

The ESD reviews were coordinated by the EEA, and were carried out in two steps: Step 1 was implemented by the EU team and made use of the procedures available in the EU QA/QC system, taking into account both the existing quality assurance/quality control procedures for Member States' emission inventory submissions under EU legislation and the separate inventory review process occurring under the UNFCCC. Step 2 was implemented by independent review teams comprising of lead reviewers and sector experts. The ESD reviews were carried out either as comprehensive review or as annual review. History of ESD reviews:

Year	Review Type	Purpose of the Review
2012	1st comprehensive Review	Determine the emission allocations 2013-2020 for the EU internal GHG emission reduction targets 2020 and respective trajectories
2015, 2017, 2018, 2019, 2021, 2022	Annual Review	Compliance with their annual ESD targets, enable the use of flexibilities and the application of corrective action, where necessary, at the end of each relevant year.
2016	2nd comprehensive Review	Review of reference years 2005, 2008-2010, 2013-2014
2020	3rd Comprehensive Review	Fix the base year and the greenhouse gas emissions targets for 2030, and the trajectory years for 2021-2029
2021	Trial LULUCF review	Voluntary review of 15 countries to prepare for the full integration of LULUCF into the review cycles from 2023 onwards.

In 2025, a comprehensive review will be carried out for all sectors and all EU Member States with a focus on the years 2021-2023 in order to determine the annual emission allocations for the years 2026 to 2030 under the Effort Sharing Regulation (ESR) for all EU Member States. In addition, in 2025 a comprehensive LULUCF review will be carried out in order to fix the linear trajectory to the 2030 LULUCF target to determine the budget for accounting of the period 2026-2029.

[18] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020; OJ L 140, 5.6.2009, p. 136–148

Capacity building activities based on the ESD / ESR reviews

After the ESD review in autumn, each year capacity building workshops/webinars are organized in order to discuss cases where MS had problems with implementing the 2006 IPCC guidelines and/or where the guidelines are not clear enough or where there are gaps and/or errors in the guidelines.

From 2017 to 2022 onwards, every year capacity building webinars have been organised for the Sectors Energy, IPPU, Agriculture, and Waste based on the most common issues detected during the EU internal reviews. Almost all Member States participated in the training sessions.

In 2021, a webinar was also organized for LULUCF based on the findings from the LULUCF trial review 2021 that was carried out in parallel with the ESD review 2021.

As a result of the capacity building webinars guidance documents have been developed to support the Member States in improving their inventories. By February 2025 19 guidance documents are available: five for the Energy Sector; six for the IPPU Sector; four for the Agriculture Sector; four for the Waste Sector.

Apart from the capacity building webinars open to all Member States the ESD project team carried out additional capacity building targeted at specific countries in 2018, 2019, 2020, 2023 and 2024 which also allowed for in-country visits.

UNFCCC reviews

In addition, European Union QA procedures build on the issues identified during the independent UNFCCC inventory review of Member States' inventories. Quality assurance procedures based on outcomes of the UNFCCC inventory review consist of the:

- Annual compilation of issues identified during the UNFCCC inventory review related to sectors, key source categories and the major inventory principles transparency, consistency, completeness, comparability and accuracy for all Member States;
- Identification of major issues from the compilation and discussion of ways to resolve them in WG1, including identification and documentation of follow-up actions that are considered as necessary within WG1;
- Reviews of the extent to which issues identified through this procedure in previous years have been addressed by Member States;
- Ongoing investigations of ways to produce a more transparent inventory for the unique circumstances of the European Union.

In February 2025 the European Union was last reviewed by the UNFCCC, the review report is not yet available.

Improvement plan

Based on the findings of the UNFCCC reviews, the EU peer review, and the EU ESD review, and other recommendations the improvement plan for the EU GHG inventory and inventory report is compiled before the annual compilation process starts. After the finalisation of the annual EU GHG inventory, it is evaluated if the improvements planned have been implemented.

1.5.5 Further improvement of the quality of inventories

One of the most important activities for improving the quality of national and EU GHG inventories is the organisation of workshops and expert meetings under EU legislation. A number of other workshops and expert meetings have been organised in recent years with a focus on sector-specific quality improvements. Table 1.10 lists the most recent workshops. The follow-up activities are subsequently addressed in meetings of WG 1 under the Climate Change Committee.

Table 1.10 Overview of recent GHG inventory related workshops and expert meetings organised by the EU

Workshop/expert meeting	Date and venue
JRC LULUCF workshop 2024	22-23 May, 2024. Ispra (VA). Italy.
JRC LULUCF workshop 2023: LULUCF inventories for enhancing climate action.	11-12 May, 2023. JRC, Ispra (VA). Italy.
JRC technical workshop: Towards 'fit for 55': updates in LULUCF reporting and accounting"	20-21 June 2022, Varese, Italy
JRC virtual technical workshop: LULUCF in transition: present and future challenges for reporting and accounting	7-8 June 2021, JRC, Ispra (VA). Italy.
JRC technical LULUCF workshop under the UNFCCC, the Kyoto Protocol (KP) and the EU LULUCF Decision No 529/2013	28-29 May 2019, Varese, Italy

1.5.6 Changes in the national inventory arrangements since previous annual GHG inventory submission

There were no changes since previous annual GHG inventory submission.

1.6 General uncertainty evaluation

The uncertainty analysis was made on the basis of the Tier 1 uncertainty estimates, which were submitted by EU Member States as part of their EU GHG inventory reporting requirements under Article 26(3) and Annex V(Part 1)(m) of the Governance Regulation (EU) 2018/1999.

As documented in previous NID submissions, some of the Member State Tier 1 uncertainty estimates that are reported for the purpose of compiling the Union inventory are incomplete e.g. uncertainties not estimated for LULUCF and indirect CO_2 emissions, certain subsector emissions are confidential. Further complexity is also introduced by the fact that the sector and gas resolution at which uncertainties are provided varies between the countries. Since the UNFCCC submission in 2022, the methodology for compiling the EU inventory uncertainties harmonises and gap-fills the MS uncertainty estimates so that the tables containing the EU uncertainties are consistent with the final aggregate-, sector- and subsector emission values reported in the EU CRT tables and elsewhere in the NID document.

A processing routine, implemented in R, reads the individual country uncertainty files that are pre-formatted manually to assign consistent sector and gas labels to the respective estimates of emissions/removals and uncertainties. The uncertainty values are then aggregated to a common sector resolution, at which the emissions and removals reported in the Tier 1 uncertainty tables of the countries are then replaced with the respective values from the final CRT tables of the countries. These final CRT data are accessed via an SQL query of the EEA database containing the Member State CRT submissions.

Due to the issue of incompleteness mentioned above, the country-level data are then screened to identify residual emissions and removals for which no uncertainty estimates have been provided. Where sectors are partially complete, the residual net emission is quantified in CO_2 equivalents and incorporated. An uncertainty is then estimated, by calculating the overall sector uncertainty of the sources and sinks that were included in that country's reported Tier 1 uncertainty estimates and assigning this percentage average to the residual net emission. In cases where for certain sectors no uncertainties have been provided at all (e.g. indirect CO_2 emissions, LULUCF), an average sector uncertainty in percent is calculated from all the countries for which complete sectoral emissions and uncertainties were reported, and this average uncertainty is assigned to the country's sector GHG total reported in its final CRT tables.

With complete data on uncertainties as well as emissions and removals for all 27 EU Member States, the routine then aggregates emissions and uncertainties in units of kt CO_2e (uncertainties summed in quadrature) for a specified gas and subsector resolution at the EU level. Despite working with Tier 1 data from the countries, a hybrid approach is applied to estimate level uncertainties that allows consideration of error correlations. The gas and subsector resolution applied was chosen to allow the routine to access respective data from the CRT Table Summary 3 on emission factors and apply correlation coefficients (r) when aggregating the uncertainties. For a given gas and subsector, it is assumed that the errors of countries using default factors are completely correlated (r = 1), while errors of countries using country-specific factors are assumed uncorrelated (r = 0). For countries using a mix of default and country-specific factors, it is assumed that these errors are partially correlated (r = 0.5) with one another and with the errors of countries using the default factors only.

Based on these correlation assumptions, the routine then aggregates emissions and uncertainties for the specified gas and subsector resolution at the EU level. Uncertainties at the GHG and sector total level (Table 1.16) are then aggregated from the subsector and gas estimates assuming no correlation between subsectors and gases. However, for countries reporting very coarse resolution estimates (e.g. total sector GHG emissions/removals) or where the sector has been partially or completely gap-filled, it is assumed that these uncertainties are partially correlated (r = 0.5) with one another and with the other reported subsector- and gas level estimates. Level uncertainties on the total emissions and removals (with and without LULUCF) are then aggregated from the sector estimates assuming no correlation between sectors.

Trend uncertainties are also calculated with a hybrid method with varying assumptions with respect to error correlations in time. At the individual gas and subsector resolution of each country, a trend and trend uncertainty are calculated assuming full error correlation between the base year and latest year estimates (r = 1). In the IPCC GPG 2000, it is suggested to assume that emission factors between years are fully correlated, and activity data are independent. However, in the EU uncertainty estimate, it is assumed that activity data uncertainties also correlate to some extent between years, because typically the same data collection methods are used each year. Therefore, for the EU uncertainty estimate it was decided to assume that emissions (at the gas and subsector level) between years are fully correlated, even though this may underestimate trend uncertainty to some extent. For countries reporting very coarse resolution estimates (e.g. total sector GHG emissions/removals) or where the sector has been partially or completely gap-filled, it is assumed in the trend uncertainty that the base year and latest year uncertainties at country level are only partially correlated with one another (r = 0.5). These trends and trend uncertainties at country level are then aggregated at EU level (Table 1.16) assuming no correlation in the trend uncertainties between the countries. Correlation in trend uncertainties between countries is more difficult to quantify, where correlation between different countries in different years should also be quantified. Furthermore, the effect of correlation on uncertainty (increasing or decreasing) depends on the direction and magnitude of trend for each country and each source category. Therefore, a simple conservative assumption cannot be made, and for simplicity, it was assumed that the trend uncertainty estimates between the countries is independent. Note that the trend and trend uncertainties are calculated by aggregating in units of kt CO_2e (uncertainties summed in quadrature) and then expressed as percentages relative to the respective base year emissions/removals. The trend and level uncertainties reported throughout the NID represent 95 % confidence intervals in the respective values.

Given the Tier 1 format of the reported country level uncertainties (95 % confidence intervals assuming normal distributions) the above method for the EU applies a first order, Gaussian error propagation approach. However, given the application of the pragmatic yet defensible assumptions of error correlations described above, it nonetheless constitutes a more sophisticated, hybrid approach than required minimum Tier 1 approach under the IPCC guidelines. For instance, assuming no correlation between level uncertainties between countries would almost certainly lead to underestimates of the EU total level uncertainties. The EU inventory team therefore considers the outlined pragmatic approach a workable and defensible methodology to estimate level uncertainties. Likewise, the assumptions applied to the trend uncertainty analysis is also considered justified, given that it is most important to consider the strong uncertainty correlation in time.

Effects of correlations were tested in previous submissions both with the previous analytical method developed, and by using Monte Carlo (MC) simulation, where normal distributions were used in all the cases to ensure comparability with analytical estimates. Table 1.14 gives an example of such a comparison made in 2006. The source category chosen for the example is 4D, N_2O emissions from agricultural soils, as this category has a major effect on inventory uncertainty in most MS. Both the effects of correlations between years and between Member States were tested.

Table 1.11 Trend uncertainty for EU emissions 2006 of N_2O from agricultural soils by using different assumptions of correlation estimated using Monte Carlo simulation

Years correlate	MS correlate	Trend uncertainty
YES	YES	-27 to +26
YES	NO	±13
NO	YES	-294 to +292
NO	NO	-116 to +115

Note: "YES" denotes full correlation between years or Member States. Trend uncertainty is presented as percentage points.

It should furthermore be mentioned that applying a MC approach in the EU case would not improve the uncertainty estimate. Given that the input data are provided by the countries in a Tier 1 format assuming normal error distributions, applying a MC procedure without any further detailed assumptions on distributions would simply lead to comparable estimates as the first order approximation (Table 1.12).

Table 1.12 Comparison of trend uncertainty estimates 2005 for EU Waste Sector using the modified Tier 1 method and Monte Carlo simulation (Tier 2).

Sector	GHG	Tier 1	Tier 2
6A. Landfills	CH_4	±12	±12
6B. Wastewater	CH_4	±27	-28 to +27
6B. Wastewater	N_2O	±9	±9
6C. Waste incineration	CO_2	±7	±7
6C. Waste incineration	CH_4	±23	-23 to +24
6C. Waste incineration	N_2O	±18	±18
Waste Other	CH_4	±990	-976 to +993
Total Waste Sector		±11	±11

Note: Trend uncertainty is presented as percentage points.

Table 1.13 shows the main results of the Tier 1 uncertainty analysis for the EU. The lowest level uncertainty estimates are for Fuel combustion activities (2.4 %) and the highest estimates are for LULUCF (46.2 %). Overall level uncertainty estimates on total GHG emissions and removals including LULUCF is calculated at 4.8 %. If LULUCF is excluded, the total level uncertainty is lower at 3.4 %. With regard to trend uncertainty estimates (expressed as a percentage of base year emissions), the lowest uncertainty estimates are for Fuel combustion activities (+/-2.5 percentage points) and the highest estimates are for LULUCF (+/- 121 percentage points). Overall trend uncertainty (including LULUCF) of total emissions and removals is estimated to be 6.5 percentage points. Excluding LULUCF, the trend uncertainty is lower at 2.0 percentage points. More detailed uncertainty estimates for the source categories are provided in Chapters 3-7.

It is perhaps important to clarify that uncertainties are inherent to all kinds of estimates (statistics, measurements, model simulations etc) thus underlining the fundamental importance of uncertainty assessment. Furthermore, the estimated uncertainties here (and elsewhere in the NID) indicate the likely range around which the EU GHG emission levels and trends vary according to error assumptions on the underlying activity data and emission factors used by the Member States. They are thus estimates of confidence (95 % confidence intervals) in the results of the EU GHG emission inventory and are not indications of biases in given directions.

Overall, the uncertainty in the total EU emission and removal (excluding LULUCF) levels and trends are low at 3.4 % and 2.0 %, respectively. In general, trend uncertainty in percentage points is lower than level uncertainty given that inventory methods are applied consistently over time, meaning that uncertainties are likely correlated over time. For example, a thermometer with a given error (offset) may provide an uncertain estimate of daily air temperature on a given day, but will provide a much less uncertain estimate of temperature change between days, assuming that the error remains stable over time.

While level and trend uncertainties in total EU GHG emissions and removals are low, uncertainties do vary considerably between and within sectors, reflecting the varying difficulty in estimating emissions and removals from different sources and sinks. Level uncertainties in 1.A Fuel combustion, the largest absolute sectoral contributor to the inventory level and trend, are low at 2.3%, while for LULUCF they are much higher at 46.8%. Assessments of (sub-) sectoral uncertainty help guide targeted inventory methodological improvements that ultimately should lead to uncertainty reductions and accuracy improvements. While this is principally the responsibility of the individual Member States, it is worth noting relevant EU legislation targeting methodological improvements in some of the more uncertain sources/sinks of GHGs. For example, the amended EU LULUCF Regulation (2023/839) will require MS to move to higher Tier methodologies for all pools and categories of the LULUCF sector over the coming decade.

Table 1.13 Tier 1 uncertainty estimates of EU GHG emissions and removals (in CO_2 equivalents) for the main sectors

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A Fuel combustion activities	all	3 573 150	2 309 766	-35.4%	2.3%	2.6%
1.B Fugitive emissions	all	166 902	54 189	-67.5%	41.7%	10.5%
2. Industrial processes	all	450 359	264 784	-41.2%	8.4%	2.4%
3. Agriculture	all	489 514	364 936	-25.4%	20.8%	2.9%
4. LULUCF	all	-237 323	-198 421	-16.4%	46.8%	121.1%
5. Waste	all	185 004	108 885	-41.1%	34.8%	9.8%
Indirect CO2 emissions	all	7 642	3 442	-55.0%	17.2%	4.4%
Total (excl LULUCF)	**all**	**4 872 571**	**3 106 002**	**-36.3%**	**3.4%**	**2.0%**
Total (incl LULUCF)	**all**	**4 635 248**	**2 907 581**	**-37.3%**	**4.8%**	**6.5%**

The uncertainty assessment for the sector LULUCF shows significant changes compared with the previous EU GHG inventory submission, especially regarding the trend uncertainty. Recalculations of emissions/removals, revisions of uncertainties and changes in the resolution of the Member States' uncertainty reporting all influence the sector uncertainties. Therefore, changes in uncertainty estimates between submissions can hardly be attributed to a single cause. Nonetheless, a large part of the increase in LULUCF trend uncertainties can be attributed to Finland's revision of its 4A CO_2 uncertainty estimation (from 144% in 2024 to 935% in 2025). Additionally, Finland's share in the EU total of category 4A (CO_2 emissions) decreased from 8% in 1990 to 0.4% in 2023. Both developments influence the EU trend uncertainty.

For more detailed information on uncertainties at the sectoral level, please refer to the respective sector chapters. For more detailed information on Member States' uncertainties please refer to the Member States' submissions.

1.7 General assessment of the completeness

1.7.1 Completeness checks of Member States' submissions

The EU GHG inventory is compiled on the basis of the inventories of the EU Member States. Therefore, the completeness of the EU inventory depends on the completeness of the Member States' submissions.

In response to the Saturday paper 2010 the EU implemented an action plan in 2011 aiming at improving the completeness regarding NEs of the EU greenhouse gas inventory.

1. Given the fairly wide interpretations and applications of notation keys, the identification of a "real" gap needs expert assessment which is provided by the UNFCCC review and which cannot be automated by existing EU internal procedures. Thus any action plan implemented by the EU needs to continue to be based primarily on the UNFCCC review reports. This was in particular evident with regards to the KP LULUCF, where a carbon pool could be not reported ('NR' should be used) provided that transparent and verifiable information was provided indicating that the pool was not a source, while notation keys such as NO and NA may also sometimes be linked to incomplete estimates. In this respect it needs to be stressed that the late availability of the review reports complicates the follow-up with Member States related to potential missing GHG estimates before the next EU inventory submission.
2. The notation key 'NE' is not in all cases an indication of a problem and neither the IPCC guidelines nor the UNFCCC review guidelines foresee an automatic procedure of gap filling when NEs are reported. For example, the notation "NE" can be used if there are no methods available in the 2006 IPCC Guidelines. Overall, a fair and complete analysis of the use of "NE" including the situations highlighted in point 1 above was considered to be indispensable (see chapter 1.7.1).

Given the above considerations the specific steps of the action plan followed since 2011 are as follows:

1. Member States are required by the Governance Regulation to submit their national GHG inventories electronically to the European Commission by 15 January of each year. A software program was created by the EEA so that upon submission of the relevant json/CRT files a report is generated containing a list of all non-estimated source categories per Member State, specifying which of these source categories have been flagged in the Saturday Papers and for which ones IPCC methods are available. This report is then immediately notified to each Member State. During February the experts of the EU inventory team consult and discuss with Member States' experts inter alia:
    a. how MS have addressed and documented (or plan to address) the potential issues flagged in their Saturday Papers regarding missing estimates;
    b. the need for applying gap-filling procedures and the selection of the most appropriate methods;
    c. the need to use different notation keys.
2. Any finding with regard to the use of the notation key "NE" or relevant blank cells is communicated to the Member States' via the EMRT by 28 February latest. According to the procedures and time scales described in Annex XXI of the Implementing Regulation, the Draft EU inventory is sent to MS also by 28 February. Updated or additional inventory data submitted by MS (to remove inconsistencies or fill gaps) and complete final national inventory reports are submitted to the European Commission by 15 March.
3. In cases where, even after the two preceding steps a Member State's GHG inventory as submitted to the European Commission by 15 March still contained NEs for categories where

IPCC methods exist, and/or if such reporting has been identified as a problem in previous reviews, then the EU inventory experts, in close cooperation with Member States, prepare the missing GHG source estimates in accordance with the gap-filling provisions in Article 5 of the Commission Delegated Regulation (EU) 2020/1044[19]. Article 5(3) requires Member States to use the gap-filled estimates in their national submissions to the UNFCCC to ensure consistency between the EU inventory and Member States' inventories.

4. A general assessment of completeness is included in the EU Greenhouse Gas Inventory Report. For transparency reasons, since 2011 the EU's inventory submission contains an improved description of this section to reflect the additional improvements discussed above.

In addition to the steps detailed above, the regular QA/QC procedures established to ensure the transparency, accuracy, comparability, consistency, and completeness of the EU inventory continue to be applied. The WG1 on annual inventories continues to address issues of completeness giving them priority and the EU peer reviews and the ESD reviews focus on identifying issues that may lead to an under- or overestimation of emissions.

Since 2012 the completeness checks have been extended to the use of the notation key NO and NA. All cases where less than seven Member States reported NO or NA and all other MS reported emission estimates were checked by the sector experts and clarified with Member States, if needed. With the implementation of the new 2006 IPCC Guidelines, there is an additional check regarding 'insignificance' as described in paragraph 37 of the UNFCCC Reporting Guidelines, which was also relevant for the ESD reviews.

Member States may only report NEs if:

1. There are no 2006 IPCC methods/EFs available.
2. Emissions are considered insignificant: below 0.05% of the NT & do not exceed 500 kt CO_2 eq. The sum of insignificant NEs shall remain below 0.1% of the NT.
    a. MS shall indicate in both the NIR and the CRF completeness table why such emissions/removals have not been estimated.
    b. MS should provide justifications for exclusion in terms of the likely level of emissions in the NIR, using approximated AD and default IPCC EFs.
3. Emissions have not been reported in a previous submission, otherwise they shall be reported in subsequent submissions.

➢ If MS report unjustified NEs (according to 1. 2. and 3. above) gap-filling rules will apply

For the sectors energy, industrial processes and product use, agriculture, LULUCF and waste sector-specific checks are performed by the EU sector experts using outlier tools similar to those of the UNFCCC and other QA/QC tools. The results of the consistency and completeness checks as well as the main findings of the sector specific checks are documented in the web-based EEA Emission Review Tool (EMRT). This tool is accessible for MS inventory coordinators and inventory experts. The Member States are asked to respond to findings in this tool and if needed provide revised emission estimates or additional information.

[19] Commission Delegated Regulation (EU) 2020/1044 of 8 May 2020 supplementing Regulation (EU) 2018/1999 of the European Parliament and of the Council with regard to values for global warming potentials and the inventory guidelines and with regard to the Union inventory system and repealing Commission Delegated Regulation (EU) No 666/2014; OJ L 230, 17.7.2020, p. 1–6

For every updated inventory submission provided by the MS by 15 March follow-up checks are performed by the sector experts and additional findings are documented in the EEA Emission Review Tool (EMRT). In addition it is checked if issues identified in the QA/QC communication tool (initial checks), which are relevant for the EU inventory (report) have been clarified by the MS. If this is not the case MS are contacted for clarification.

Since 2015 also cases where neither numeric values nor notation keys have been reported (blank cells) have been included in the checking procedure. EU experts have checked with Member States if blank cells have been caused by the new CRF reporter software or if in fact the blank cells should be replaced by notation keys or a numeric values.

1.7.2 Reporting of notation key "NE"

As the EU GHG inventory is the sum of MS inventories all categories reported as "NE" by Member States are also reflected in the EU GHG inventories. However, the EU CRT include only a small number of categories where "NE" is actually visible because the "NE" of a Member State is only visible in the EU CRT in a category where all EU MS report notation keys.

1.7.3 Reporting of confidential data

According to the MPGs Parties may report specific categories with the notation key C in case of confidentiality. In 2023 only two MS made use of this option; for the year 2021 Croatia reported CO_2, CH_4 and N_2O emission from 1D2 as confidential (Multilateral operations), while Sweden reported correct sector totals for all sectors but in the sectors Energy and IPPU on a less aggregated level the country reported 26 sub-categories as confidential. Please note that the EU GHG inventory team – on request - obtains access to confidential MS data for quality checking purposes which has been the case for Sweden in 2023.

Therefore, in the relevant sector chapters, EU trends at fuel level do not always include Sweden for confidentiality reasons and also to preserve time series consistency for the EU. Consequently, the EU CRT tables at sub-category level and data shown on the same level in the NID are not always consistent. Note that at sector level and at national totals level the EU NID and the EU CRT are fully consistent.

Table 1.14 Confidential data reported by MS in key categories for the EU

Source category gas	**Confidential data**	
	1990	**2023**
1.A.1.a. Public electricity and heat production: Gaseous Fuels (CO_2)		SWE
1.A.1.a. Public electricity and heat production: Liquid Fuels (CO_2)		SWE
1.A.1.b. Petroleum refining: Gaseous Fuels (CO_2)		SWE
1.A.1.b. Petroleum refining: Liquid Fuels (CO_2)		SWE
1.A.2.d. Pulp, paper and print: Liquid Fuels (CO_2)		SWE
1.A.2.e. Food processing, beverages and tobacco: Liquid Fuels (CO_2)		SWE
1.A.2.f. Non-metallic minerals: Other Fuels (CO_2)		SWE
1.A.2.f. Non-metallic minerals: Solid Fuels (CO_2)		SWE
2.A.1. Cement production: no classification (CO_2)		SWE
2.A.2. Lime production: no classification (CO_2)		SWE

As the EU GHG inventory is the sum of MS inventories all categories reported as confidential by Member States are also reflected in the EU GHG inventories. If Member States report confidential data the notation key "C" will be shown in the comments of the relevant cell in the CRT only.

1.7.4 Data gaps and gap-filling

1.7.4.1 Gap filling of emissions

The EU GHG inventory is compiled by using the inventory submissions of the EU Member States. If a Member State does not submit all data required for the compilation of the EU inventory by 15 March of a reporting year, the Commission prepares estimates for data missing in collaboration with the relevant Member State based on the following methodologies and data:

where a Member State has submitted in the previous reporting year a consistent time series of estimates for the relevant source category and:

- that Member State has submitted an approximated greenhouse gas inventory for the year X – 1 pursuant to Article 26(2) of Regulation (EU) 2018/1999 that includes the missing estimate, on the data from that approximated greenhouse gas inventory;
- that Member State has not submitted an approximated greenhouse gas inventory for the year X – 1 under Article 26(2) of Regulation (EU) 2018/1999, but the Union has estimated approximated greenhouse gas emissions for the year X – 1 for that Member State in accordance with Article 26(2) of Regulation (EU) 2018/1999[20], on the data from that Union approximated greenhouse gas inventory;
- the use of the data from the approximated greenhouse gas inventory of the Member State is not possible or may lead to a highly inaccurate estimation, for missing estimates in the energy sector, on the energy statistics data obtained in accordance with Regulation (EC) No 1099/2008 of the European Parliament and of the Council;
- the use of the data from the approximated greenhouse gas inventory is not possible or may lead to a highly inaccurate estimation, for missing estimates in non-energy sectors, on estimation methodologies consistent with the technical advice on gap filling in Section 2.2.3 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Vol. 1) using, where appropriate, European statistics;

where an estimate of an emission by source or removal by sink for the relevant category was subject to technical corrections in accordance with Article 38(2)(d) of Regulation (EU) 2018/1999 in the latest review prior to the submission and the Member State concerned has not submitted a revised estimate, on the method used by the technical expert review team to calculate the technical correction;

where a consistent time series of reported estimates for the relevant source category is not available, on estimation methodologies consistent with the technical advice on gap filling in Section 2.2.3 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Vol. 1).

The Commission prepares the estimates by 31 March of the reporting year, following consultation with the Member State concerned, and communicates the estimates to the other Member States. The Member State concerned shall use the estimates referred to for its national submission to the UNFCCC to ensure consistency between the EU inventory and Member States' inventories.

The methods used for gap filling include interpolation, extrapolation and clustering. These methods are consistent with the 2006 IPCC guidelines[21].

Since 2011 GHG inventory estimates have been complete for all EU Member States, and therefore no gap filling has been needed.

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[20] Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics; OJ L 304, 14.11.2008, p. 1

[21] ETC ACC technical note on gap filling procedures, December 2006.

1.7.4.2 Gap filling of activity data

In response to recommendations of the UNFCCC review team the EU elaborated and implemented a gap filling procedure for gaps in activity data. Due to the large resource needs for gap filling the following rules apply:

- Only activity data for key categories will be gap-filled.
- If more than 75 % of the emissions are calculated on basis of consistent activity data.
- If the IEF has a reasonable degree of consistency (i.e. standard deviation divided by mean < 50 %).
- Only for the latest reporting year.

Applying the rules mentioned above activity data of the following categories have been gap-filled in this inventory submission for the year 2023:

- Cement Production 2A1
- Lime Production 2A2
- Ammonia Production 2B1
- Nitric Acid Production 2B3

1.7.5 Geographical coverage of the European Union inventory

Table 1.15 shows the geographical coverage of the EU Member States' national inventories. Note that the EU territory of a Member State is not always equivalent to the territory of the Party to the UNFCCC. For two Member States there are differences in geographical coverage as UNFCCC Party and/or EU Member State (Denmark and France). If there are differences in geographical coverage the respective country needs to prepare more than one inventory.

As the EU inventory is the sum of the Member States' inventories, the EU inventory covers the same geographical area as the inventories of the 27 Member States for their respective EU territory. Note that Denmark and France submit GHG inventories to the UNFCCC that may differ from the GHG inventories used for the EU inventory because these countries submit an inventory to the UNFCCC, which is consistent with the Party coverage of these countries. However, the EU's submission under the Convention is fully consistent with MS GHG emissions by sources and sinks according to the EU territory (see Table 1.15).

Table 1.15 Geographical coverage of the Union's GHG inventory

Member State	Geographical coverage	EU-territory coverage	Country code
Austria	Austria	✓	AUT
Belgium	Belgium consisting of Flemish Region, Walloon Region and Brussels Region	✓	BEL
Bulgaria	Bulgaria	✓	BGR
Croatia	Croatia	✓	HRV
Cyprus	Area under the effective control of the Republic of Cyprus	✓	CYP
Czechia	Czech Republic	✓	CZE
Denmark	Denmark (excluding Greenland and the Faeroe Islands)	✓	DNM
	Denmark (including Greenland and the Faeroe Islands)		DNK
Estonia	Estonia	✓	EST
Finland	Finland including Åland Islands	✓	FIN

Member State	Geographical coverage	EU-territory coverage	Country code
France	Metropolitan France, the overseas departments (Guadeloupe, Martinique, French Guiana, Réunion and Mayotte) and the overseas community Saint-Martin; excluding the overseas communities French Polynesia, Wallis and Futuna, Saint-Pierre and Miquelon, and Saint-Barthélemy; and excluding the overseas territories (the French Southern and Antarctic Lands) and New Caledonia.	✓	FRK
	Metropolitan France, the overseas departments, the overseas communities, overseas territories and New Caledonia.		FRA
Germany	Germany	✓	DEU
Greece	Greece	✓	GRC
Hungary	Hungary	✓	HUN
Ireland	Ireland	✓	IRE
Italy	Italy	✓	ITA
Latvia	Latvia	✓	LVA
Lithuania	Lithuania	✓	LTU
Luxembourg	Luxembourg	✓	LUX
Malta	Malta	✓	MLT
Netherlands	The reported emissions are those that derive from the legal territory of the Netherlands. This includes a 12-mile zone out from the coastline and inland water bodies. It excludes the Dutch Caribbean territories Aruba, Curaçao and Sint Maarten, which are constituent countries of the Kingdom of the Netherlands. It also excludes Bonaire, Saba and Sint Eustatius, which since 10 October 2010 have been public bodies (openbare lichamen) with their own legislation that is not applicable to the European part of the Netherlands. Emissions from offshore oil and gas production on the Dutch part of the continental shelf are included.	✓	NLD
Poland	Poland	✓	POL
Portugal	Mainland Portugal and the two Autonomous regions of Madeira and Azores Islands. Includes also emissions from air traffic and navigation bunkers realised between these areas.	✓	PRT
Romania	Romania	✓	ROU
Slovakia	Slovakia	✓	SVK
Slovenia	Slovenia	✓	SVN
Spain	Spanish part of Iberian mainland, Canary Islands, Balearic Islands, Ceuta and Melilla	✓	ESP
Sweden	Sweden	✓	SWE
European Union	EU-27	✓	EUA

1.7.6 Completeness of the European Union submission

1.7.6.1 National inventory document

The EU NID follows – as far as possible - the annotated outline of the national inventory document following Annex V of Decision 5/CMA.3, with the exception of the annexes. The main reason for this is the nature of the EU inventory being the sum of Member States' inventories. Therefore the main purpose of the annexes is to make transparent the EU emission estimates by providing the basic Member States tables for every CRF table. Table 1.16 provides information on what is included in the Annexes to the EU GHG inventory report and provides explanations where the EU does not follow the UNFCCC reporting guidelines.

Table 1.16 Annexes as outlined in the UNFCCC reporting guidelines and annexes included in the EU submission

	Annex included in the EU submission
Annex I: Key categories	Included: Key category analyses Tier 1 including and excluding LULUCF
Annex II: Assessment of uncertainty	The uncertainty assessment is included in the NID, section 1.6
Annex III: Any additional information, as applicable, including detailed methodological descriptions of source or sink categories and the national emission balance	Included: A summary description of the methodologies used by each Member State for the EU key categories

1.7.6.2 Activity data in the EU CRT/JSON

The European Union cannot provide all data in the sectoral background tables. The main reasons for not completing all sectoral background data tables are: (1) limited data availability partly due to confidentiality issues; and (2) the use of different type of activity data by Member States. The latter is due to the fact that the Member States are responsible for calculating emissions. If they use country-specific methods they may also use different types of activity data. At EU-level these different types of activity data cannot be simply added up. It should be noted that at EU-level no emissions are calculated directly on the basis of activity data reported by MS. However, all the details for the calculation of MS emissions are documented in the Member States' CRT, as part of their national GHG inventories.

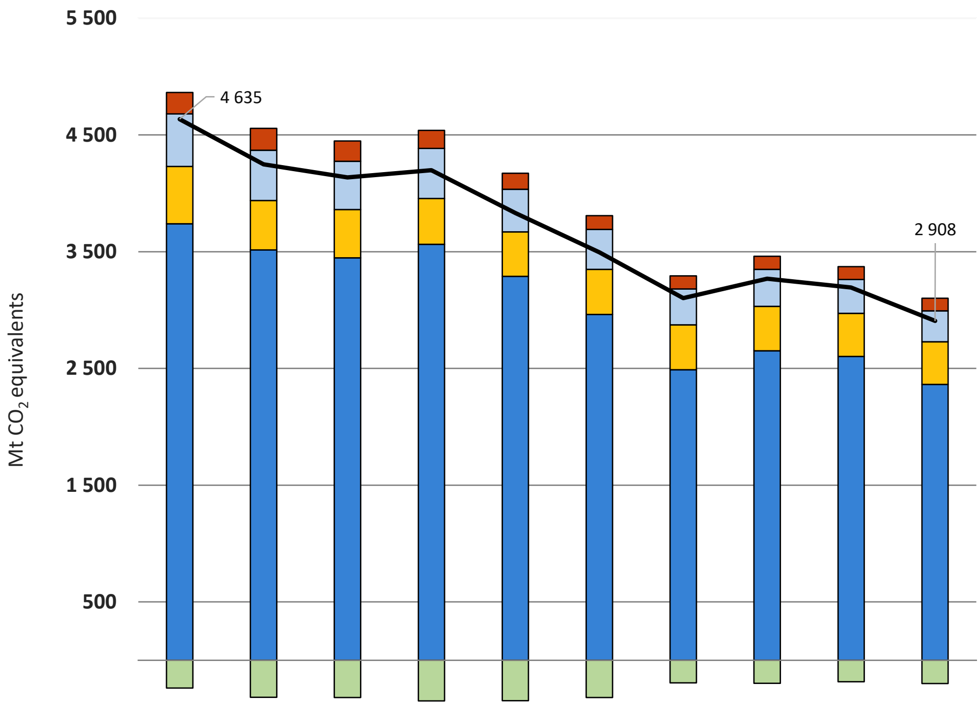
2 TRENDS IN EU GREENHOUSE GAS EMISSION AND REMOVALS

This chapter presents the main GHG emission trends in the EU. Aggregated results are described as regards total GHG and emission trends are briefly analyzed mainly at gas level. A short overview of countries contributions to total EU GHG trends is given. Finally, the trends of indirect GHGs and SO_2 emissions are presented.

2.1 Aggregated greenhouse gas emissions and removals

In 2023, total GHG emissions in the EU[22], including LULUCF and indirect CO_2, were 37 % (-1 728 million tonnes CO_2 equivalents) below 1990 levels. Emissions decreased by 8.9 % (-285 million tonnes CO_2 equivalents) between 2022 and 2023 (Figure 2.1).

Figure 2.1 EU GHG emissions and removals 1990–2023



	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
LULUCF	-237	-316	-318	-347	-346	-319	-194	-196	-183	-198
Waste	185	187	174	155	137	119	112	112	111	109
IPPU	450	430	414	429	364	342	307	318	290	265
Agriculture	490	424	413	392	381	386	384	380	368	365
Energy	3 740	3 515	3 447	3 565	3 290	2 962	2 490	2 651	2 604	2 364
Total net GHG emissions (including indirect CO2)	4 635	4 248	4 137	4 199	3 831	3 495	3 103	3 269	3 193	2 908

Notes: CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC guidelines and are not included in national totals. In addition, no adjustments for temperature variations or electricity trade are considered. The 100-year global warming potentials are those from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

[22] Unless otherwise specified, the national GHG totals in this report always include LULUCF. They may also be referred to as 'net' total GHG emissions. The other UNFCCC sectors that are included in the national totals are energy, industrial processes and product use, agriculture, waste and indirect CO_2 emissions.

2.1.1 Main trends by source category, 1990-2023

Total GHG emissions (including LULUCF and indirect CO_2 emissions) decreased by 1 728 Mt CO_2 eq. since 1990 reaching 2 908 Mt CO_2 equivalent in 2023. These emissions exclude international aviation and international navigation.

There has been a progressive decoupling between gross domestic product (GDP) and emissions, with GDP increasing by 70% and greenhouse gas emissions falling by 37% between 1990 and 2023.

The trend in GHG emissions over the 33-year period was driven by a variety of factors, including the growing share in the use of renewables, the use of less carbon intensive fossil fuels and improvements in energy efficiency, as well as to structural changes in the economy.

The long-lasting changes have resulted in a lower energy intensity of the economy and in a lower carbon intensity of energy production and consumption in 2023 compared to 1990. Demand for energy to heat households has also been lower, as, besides better insulation standards in buildings, Europe on average has experienced milder winters since 1990, which has also helped reduce emissions.

GHG emissions decreased in the majority of sectors between 1990 and 2023, with the notable exception of transport, refrigeration and air conditioning, where emissions increased, and forest land, where net removals decreased and the negative trend accelerated in the past few years. The main reasons for the decrease in net removals include the aging of the forests from the late 2000s and a lower annual increment, as well as increased harvesting and the negative impacts from climate change. At the aggregate level, emission reductions were largest for public electricity and heat production, manufacturing industries and construction, residential combustion, and iron and steel production (including energy-related emissions).

A combination of factors can explain lower emissions in industrial sectors, such as improved efficiency and lower carbon intensity as well as structural changes in the economy, with a higher share of services and a lower share of more-energy-intensive industry in total GDP. For industry as a whole, including both combustion and processes, EU emissions decreased by 46% between 1990 and 2023.

Emissions from electricity and heat production also decreased strongly, by 53%, over the past 33 years since 1990. In addition to improved energy efficiency there has been a move towards less carbon intense fuels. Between 1990 and 2023, the use of solid and liquid fuels in thermal power stations decreased strongly (by 64 % and 85 %, respectively) whereas natural gas consumption developed in the opposite direction (increasing by 48 %). Coal consumption in 1990 was almost three times higher than in 2023. The use of renewable energy sources in electricity and heat generation has increased substantially in the EU since 1990. Improved energy efficiency and a less carbon intensive fuel mix have resulted in reduced CO_2 emissions per unit of fossil energy generated.

Emissions in the residential sector also represented one of the largest reductions. Energy efficiency improvements from better insulation standards in buildings, and a less carbon-intensive fuel mix, can partly explain lower demand for space heating in the EU over the past 33 years.

In terms of the main GHGs, CO_2 was responsible for the largest reduction in emissions since 1990. Reductions in emissions from N_2O and CH_4 have also been substantial, reflecting among other things lower levels of mining activities, lower agricultural livestock, as well as lower emissions from managed waste disposal on land and from reduced adipic and nitric acid production.

A number of policies, both EU and Member State specific, have contributed to the overall GHG emission reduction, such as key agricultural and environmental policies in the 1990s and climate and energy policies in the past two decades since 2005. The latter include the implementation of the EU Emissions Trading System as well as national policies for the sectors not covered by this system. More information on policies and measures can be found in the EU's first Biennial Transparency Report under the Enhanced Transparency Framework of the Paris Agreement.

Almost all EU Member States reduced emissions compared to 1990 and thus contributed to the overall positive EU performance (Table 2.3). Germany, Romania, Italy and France accounted for almost two thirds of the total net reduction in EU emissions during the past 33 years.

Table 2.1 shows those categories that made the largest contribution to the change in total GHG emissions and removals in the EU between 1990 and 2023.

Table 2.1 Overview of EU categories whose emissions and/or removals increased or decreased by more than 20 million tonnes CO_2 equivalent in the period 1990–2023

Source category	Million tonnes (CO_2 equivalents)
Road Transportation (CO_2 from 1.A.3.b)	139
Forest land remaining forest land (CO_2 from 4.A.1)	101
Refrigeration and Air conditioning (HFCs from 2.F.1)	51
Cropland remaining cropland (CO_2 from 4.B.1)	-20
Unmanaged Waste Disposal Sites (CH_4 from 5.A.2)	-22
Agricultural soils: Direct N_2O emissions (N_2O from 3.D.1)	-27
Grassland (CO_2 from 4.C)	-28
Adipic Acid Production (N_2O from 2.B.3)	-33
Cement Production (CO2 from 2.A.1)	-34
Managed Waste Disposal Sites (CH_4 from 5.A.1)	-37
Nitric Acid Production (N_2O from 2.B.2)	-39
Cropland (CO_2 from 4.B)	-39
Fugitive Emissions from Oil and Natural Gas (CH_4 from 1.B.2)	-46
Enteric Fermentation: Cattle (CH_4 from 3.A.1)	-51
Fugitive Emissions from Solid Fuels (CH_4 from 1.B.1)	-61
Fuels used Commercial/Institutional Sector (CO_2 from 1.A.4.a)	-69
Manufacture of Solid Fuels and Other Energy Industries (CO_2 from 1.A.1.c)	-73
Iron and Steel Production (CO_2 from 1.A.2.a + 2.C.1)	-133
Fuels used Residential Sector (CO_2 from 1.A.4.b)	-175
Manufacturing industries (excl. Iron and steel) (Energy-related CO_2 from 1.A.2 excl. 1.A.2.a)	-273
Public Electricity and Heat Production (CO_2 from 1.A.1.a)	-658
Total	**-1728**

Notes: As the table only presents sectors whose emissions have increased or decreased by at least 20 million tonnes CO_2 equivalent, the sum of the EU key categories in this table does not match the total change in emissions listed at the bottom of the table, which includes all emission sources in the EU inventory. Note that LULUCF categories and the indirect CO_2 emissions are reflected in this table.

2.1.2 Main trends by source category, 2022-2023

Total GHG emissions (including LULUCF) decreased in 2023 by 285 million tonnes, or 8.9 % compared to 2022, to reach 2 907 Mt CO_2 equivalent in 2023. The year 2023 performance represents the largest relative (%) reduction in GHG emissions in the EU since 1990, and the third largest in absolute terms – only after the 2009 financial crisis and the 2020 COVID-19 pandemic.

The largest decrease in emissions in 2023 occurred in the energy sector, and particularly in public electricity and heat production, where emissions decreased by 22% (corresponding to 161 Mt CO_2e). This represents the largest decrease in emissions from electricity and heat generation in the EU of the past 33 years of inventory data since 1990.

The reduction in emissions in the power sector took place in a context of lower total energy consumption in the EU in 2023 and was due to both a strong reduction in the consumption of coal and natural gas as well as a significant increase in renewable energy consumption.

According to Eurostat data, the use of renewable energy increased significantly in 2023, mostly due to hydro, wind and solar (bioenergy consumption decreased in 2023).

Table 2.2 shows the categories making the largest contribution to the change in GHG emissions and removals in the EU between 2022 and 2023.

Table 2.2 Overview of EU categories whose emissions and/or removals increased or decreased by more than 3 million tonnes CO_2 equivalent in the period 2020–2023

Source category	Million tonnes (CO_2 equivalents)
Harvested wood products (CO_2 from 4.G)	8
Fuels used Commercial/Institutional Sector (CO_2 from 1.A.4.a)	-5
Cement Production (CO_2 from 2.A.1)	-6
Road Transportation (CO_2 from 1.A.3.b)	-8
Iron and Steel Production (CO_2 from 1.A.2.a + 2.C.1)	-8
Forest land remaining forest land (CO_2 from 4.A.1)	-20
Fuels used Residential Sector (CO_2 from 1.A.4.b)	-25
Manufacturing industries (excl. Iron and steel) (Energy-related CO_2 from 1.A.2 excl. 1.A.2.a)	-26
Public Electricity and Heat Production (CO_2 from 1.A.1.a)	-161
Total	**-285**

Notes: As the table only presents sectors whose emissions have increased or decreased by at least 3 million tonnes of CO_2 equivalent, the sum of the EU key categories in this table does not match the total change in emissions listed at the bottom of the table, which includes all emission sources in the EU inventory. Note that LULUCF categories and the indirect CO_2 emissions are reflected in this table.

Table 2.3 gives an overview on total GHG emissions by Member States, illustrating where main changes occurred.

Table 2.3 Greenhouse gas emissions in CO_2 equivalent (incl. LULUCF and incl. indirect CO_2)

	1990 (million tonnes)	2023 (million tonnes)	2022 - 2023 (million tonnes)	Change 2022 - 2023 (%)	Change 1990-2023 (%)	Share MS/EU 2023
Austria	65.9	76.2	2.9	4.0%	15.7%	2.6%
Belgium	142.8	97.9	-4.5	-4.4%	-31.4%	3.4%
Bulgaria	81.8	36.8	-12.5	-25.4%	-55.0%	1.3%
Croatia	25.2	19.9	0.2	1.2%	-21.1%	0.7%
Cyprus	5.4	8.2	0.1	1.9%	50.9%	0.3%
Czechia	186.7	98.9	-17.5	-15.1%	-47.0%	3.4%
Denmark	79.2	38.8	-3.6	-8.4%	-51.0%	1.3%
Estonia	35.3	13.0	-1.4	-9.4%	-63.2%	0.4%
Finland	49.4	53.1	-4.7	-8.1%	7.5%	1.8%
France	524.2	339.0	-30.5	-8.2%	-35.3%	11.7%
Germany	1288.4	740.7	-83.7	-10.2%	-42.5%	25.5%
Greece	101.7	67.8	-4.8	-6.6%	-33.3%	2.3%
Hungary	91.6	48.5	-4.5	-8.4%	-47.1%	1.7%
Ireland	60.8	58.8	-3.8	-6.0%	-3.3%	2.0%
Italy	519.1	331.2	-42.5	-11.4%	-36.2%	11.4%
Latvia	13.5	14.6	-1.2	-7.6%	7.9%	0.5%
Lithuania	43.2	12.6	0.0	0.2%	-70.7%	0.4%
Luxembourg	12.8	7.1	-0.4	-5.0%	-44.5%	0.2%
Malta	2.6	2.2	0.0	-0.6%	-14.1%	0.1%
Netherlands	227.5	146.4	-10.6	-6.7%	-35.6%	5.0%
Poland	442.9	315.8	-28.6	-8.3%	-28.7%	10.9%
Portugal	63.3	51.2	-4.8	-8.5%	-19.1%	1.8%
Romania	230.4	57.4	-6.5	-10.2%	-75.1%	2.0%
Slovakia	64.6	28.3	-1.3	-4.4%	-56.1%	1.0%
Slovenia	14.5	10.5	-0.8	-7.3%	-27.3%	0.4%
Spain	250.5	218.9	-22.7	-9.4%	-12.6%	7.5%
Sweden	11.9	13.2	2.6	24.3%	11.0%	0.5%
EU-27	4635	2908	-285.0	-8.9%	-37.3%	

Notes: Due to an error in the aggregation of the waste subcategories in the Cypriot inventory, the sum of all Member States for 2020-2023 does not add up to the EU-27 value. There is a difference of approximately 0.4 Mt CO_2 equivalent.

2.2 Emission and removal trends by gas

Table 2.10 gives an overview of the main trends in EU GHG emissions and removals for 1990-2023. In the EU the most important GHG is CO_2, accounting for 78 % of total EU emissions in 2023 including LULUCF. In 2023, CO_2 emissions including LULUCF were 2 266 Mt, which was 37 % below 1990 levels. Compared to 2022, CO_2 emissions decreased by 11 %. During that period CH_4 emissions decreased by 1.9 % and N_2O emissions decreased by 0.5 %.

Table 2.4 Overview of EU GHG emissions and removals from 1990 to 2023 in CO_2 equivalent

GREENHOUSE GAS EMISSIONS	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
Net CO_2 emissions/removals	3 614	3 302	3 267	3 375	3 066	2 765	2 421	2 592	2 538	2 266
CO_2 emissions (without LULUCF)	3 881	3 648	3 613	3 748	3 438	3 108	2 639	2 814	2 747	2 493
CH_4	671	613	561	513	475	447	421	419	411	403
N_2O	300	277	246	234	196	190	188	188	177	176
HFCs	12.9	21.5	41.8	62.7	83.7	83.1	65.5	62.4	60.3	57.0
PFCs	21.8	15.1	10.5	6.3	3.2	2.8	1.8	1.6	1.4	1.0
Unspecified mix of HFCs and PFCs	5.1	5.3	2.2	1.2	0.6	0.7	1.5	1.5	1.1	0.2
SF_6	9.9	14.1	8.6	6.7	5.8	5.9	5.4	4.9	4.3	4.0
NF_3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total (with net CO_2 emissions/removals)	**4 635**	**4 248**	**4 137**	**4 199**	**3 831**	**3 495**	**3 103**	**3 269**	**3 193**	**2 908**
Total (without LULUCF)	**4 873**	**4 563**	**4 455**	**4 546**	**4 177**	**3 813**	**3 297**	**3 465**	**3 376**	**3 106**

Notes: CO_2 emissions include indirect CO_2. Please note that historical data may have changed compared to last year's Inventory Report due to recalculations

The largest key categories for CO_2 emissions and removals (Table 2.11) have been reduced between 1990 and 2023 with the exception of 1.A.3.b Road transportation.

Table 2.5 CO_2 emissions by large key categories: absolute and relative change 1990 to 2023 in CO_2 equivalents (Mt) and their share in 2023 EU Total CO_2 emissions

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
1.A.3.b - Road Transportation	609764	749090	139	23%	30%
1.A.1.b - Petroleum Refining	107030	92901	-14	-13%	4%
2.C.1.a - Steel Production	77597	44887	-33	-42%	2%
2.A.1 - Cement Production	95237	61198	-34	-36%	2%
1.A.4.a - Commercial/Institutional	169604	100644	-69	-41%	4%
1.A.4.b - Residential	426454	251588	-175	-41%	10%
1.A.2 - Manufacturing Industries and Construction	715454	358305	-357	-50%	14%
1.A.1.a - Public Electricity and Heat Production	1226218	567984	-658	-54%	23%
All other CO2 emissions	453677	266280	-187	-41%	11%
Total CO2	**3881034**	**2492877**	**-1388**	**-36%**	**100%**

Note: Other is calculated by subtracting the presented categories from the sector total excluding LULUCF. Percentages are rounded and may lead to a sum higher or lower than 100 %

CH_4 emissions account for 14 % of total EU GHG emissions in 2023 and decreased by 40 % since 1990 to 403 Mt CO_2 equivalents in 2023 (Table 2.6). The two largest key categories are enteric fermentation from cattle and anaerobic waste. They account for 54 % of CH_4 emissions in 2023.

Table 2.6 shows that the main reasons for declining CH_4 emissions were reductions in coal mining, cattle population and natural gas operations.

Table 2.6 CH_4 emissions by large key categories: absolute and relative change 1990 to 2023 in CO_2 equivalents (Mt) and their share in 2023 EU Total CH_4 emissions

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
1.A.4 - Other Sectors	23795	16632	-7	-30%	4%
3.A.2 - Enteric Fermentation - Sheep	23179	15442	-8	-33%	4%
3.B.1 - CH4 Emissions - Farming	55973	44941	-11	-20%	11%
5.D - Wastewater Treatment and Discharge - Wastewater	36609	16035	-21	-56%	4%
5.A.1.a - Anaerobic - Waste	95637	64514	-31	-33%	16%
1.B.2.b - Natural Gas - Operation	47005	11275	-36	-76%	3%
3.A.1 - Enteric Fermentation - Cattle	204739	153699	-51	-25%	38%
1.B.1.a - Coal Mining and Handling - Operation	82199	21939	-60	-73%	5%
All other CH4 emissions	101626	58229	-43	-43%	14%
Total CH4	**670762**	**402708**	**-268**	**-40%**	**100%**

Note: Other is calculated by subtracting the presented categories from the sector total excluding LULUCF. Percentages are rounded and may lead to a sum higher or lower than 100 %

N_2O emissions are responsible for 6 % of total EU GHG emissions and decreased by 41 % to 176 Mt CO_2 equivalents in 2023 (Table 2.7). N_2O emissions derive mainly from the agriculture sector. The two largest key categories account for about 62 % of N_2O emissions in 2023. Table 2.6 shows that the main reason for large N_2O emission cuts were reductions in chemical industry and agricultural soils.

Table 2.7 N_2O emissions by large key categories: absolute and relative change 1990 to 2022 in CO_2 equivalents (Mt) and their share in 2023 EU Total N_2O emissions

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
1.A.3.b - Road Transportation	4738	6981	2	47%	4%
5.D - Wastewater Treatment and Discharge - Wastewater	7891	9553	2	21%	5%
1.A.1.a - Public Electricity and Heat Production	5283	3925	-1	-26%	2%
3.B.2 - N2O and NMVOC Emissions - Farming	27241	17643	-10	-35%	10%
3.D.2 - Agricultural Soils - Farming	33008	22366	-11	-32%	13%
3.D.1 - Agricultural Soils - Direct N2O Emissions	113209	86551	-27	-24%	49%
2.B - Chemical Industry	78849	2546	-76	-97%	1%
All other N2O emissions	30214	26643	-4	-12%	15%
Total N2O	**300431**	**176208**	**-124**	**-41%**	**100%**

Note: Other is calculated by subtracting the presented categories from the sector total excluding LULUCF. Percentages are rounded and may lead to a sum higher or lower than 100 %

Fluorinated gas emissions account for 2 % of total EU GHG emissions. In 2023, emissions amounted to 62 Mt CO_2 equivalents, which was 25 % above 1990 levels (Table 2.8). Refrigeration and air conditioning, the largest key category, accounts for 82 % of fluorinated gas emissions in 2023. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). On the other hand, the sum of HFC emissions from categories not presented individually in Table 2.8 decreased substantially.

Table 2.8 F-Gases emissions by large key categories: absolute and relative change 1990 to 2023 in CO_2 equivalents (Mt) and their share in 2023 EU Total F-Gases emissions

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
2.F.1 - Refrigeration and Air conditioning - HFCs	4.7	51247	51	1098959%	82%
2.F.3 - Fire Protection - HFCs	0.0	2327	2	NA	4%
2.F.4 - Aerosols - HFCs	1.5	1785	2	121772%	3%
2.F.2 - Foam Blowing Agents - HFCs	0.0	1252	1	NA	2%
2.G.2 - SF6 and PFCs from Other Product Use - SF6	4275	2127	-2	-50%	3%
All other F-gas emissions	45389	3526	-42	-92%	6%
Total F-gases	**49671**	**62264**	**13**	**25%**	**100%**

Note: Other is calculated by subtracting the presented categories from the sector total excluding LULUCF. Percentages are rounded and may lead to a sum higher or lower than 100 %

2.3 Emission and removal trends by sector

Table 2.9 gives an overview of EU emissions in the main source and sink categories for 1990–2023. The most important sector in terms of GHG emissions is energy (i.e. combustion and fugitive emissions), which accounted for 81 % of total emissions including LULUCF in 2023. The second largest sector is agriculture (13 %), followed by industrial processes (9 %). The LULUCF sector accounted for -7 % of the EU's net national total emissions in 2023. More detailed trend descriptions are included in the individual sector chapters (chapters 3-7) and chapter 9 on indirect CO_2 emissions.

Table 2.9 Overview of EU GHG emissions (in million tonnes CO_2 equivalent) in the main source and sink categories for the period 1990 to 2023

GHG SOURCE AND SINK	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
1. Energy	3 740	3 515	3 447	3 565	3 290	2 962	2 490	2 651	2 604	2 364
2. Industrial Processes	450	430	414	429	364	342	307	318	290	265
3. Agriculture	490	424	413	392	381	386	384	380	368	365
4. Land-Use, Land-Use Change and Forestry	-237	-316	-318	-347	-346	-319	-194	-196	-183	-198
5. Waste	185	187	174	155	137	119	112	112	111	109
6. Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indirect CO_2 emissions	7.6	6.9	6.3	5.7	4.8	4.1	3.9	3.9	3.6	3.4
Total (with net CO_2 emissions/removals)	**4 635**	**4 248**	**4 137**	**4 199**	**3 831**	**3 495**	**3 103**	**3 269**	**3 193**	**2 908**
Total (without LULUCF)	**4 873**	**4 563**	**4 455**	**4 546**	**4 177**	**3 813**	**3 297**	**3 465**	**3 376**	**3 106**

2.4 Emission trends by Member State

Table 2.10 gives an overview of EU Member States' contributions to the EU emissions including LULUCF and indirect CO_2 for 1990–2023. Countries show large variations in GHG emission trends.

Table 2.10 Overview of countries contributions to total EU GHG emissions, including LULUCF and including indirect CO_2 emissions from 1990 to 2023 in million tonnes CO_2 equivalent

Member State	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
Austria	65.9	62.2	63.3	78.1	73.7	75.3	73.7	74.7	73.3	76.2
Belgium	142.8	151.1	146.7	143.1	132.8	117.8	106.6	109.4	102.5	97.9
Bulgaria	81.8	55.4	40.8	46.8	47.9	52.9	38.7	44.9	49.3	36.8
Croatia	25.2	14.3	19.1	22.0	21.4	19.1	18.2	18.7	19.7	19.9
Cyprus	5.4	6.8	8.2	9.0	9.2	8.0	7.8	7.9	8.0	8.2
Czechia	186.7	146.6	139.6	138.5	131.4	117.9	119.5	121.8	116.5	98.9
Denmark	79.2	85.9	78.2	73.8	68.0	50.5	44.7	44.5	42.4	38.8
Estonia	35.3	15.5	14.5	16.7	16.3	18.6	12.5	13.4	14.3	13.0
Finland	49.4	50.8	49.7	45.6	54.7	43.8	49.6	59.2	57.8	53.1
France	524.2	511.2	525.3	499.6	473.0	420.4	358.3	384.8	369.5	339.0
Germany	1288.4	1116.1	1047.0	1011.1	935.6	907.6	809.6	824.5	824.4	740.7
Greece	101.7	106.5	124.1	133.2	115.8	92.6	70.7	73.0	72.6	67.8
Hungary	91.6	71.3	74.3	71.4	62.2	56.7	55.9	56.8	53.0	48.5
Ireland	60.8	65.9	74.8	76.4	66.9	64.4	62.3	64.5	62.6	58.8
Italy	519.1	513.6	541.6	562.4	483.2	401.6	340.2	374.1	373.7	331.2
Latvia	13.5	-2.3	-1.8	4.4	9.8	11.0	11.0	12.7	15.8	14.6
Lithuania	43.2	17.6	9.1	17.1	9.6	12.2	14.4	14.3	12.6	12.6
Luxembourg	12.8	9.6	9.1	12.5	12.0	9.9	8.5	8.7	7.5	7.1
Malta	2.6	2.7	2.7	3.0	3.0	2.1	2.1	2.1	2.3	2.2
Netherlands	227.5	236.5	224.6	220.1	219.4	199.9	168.3	170.6	157.0	146.4
Poland	442.9	423.9	354.2	347.6	367.9	348.1	347.2	374.4	344.4	315.8
Portugal	63.3	64.1	83.7	90.5	65.8	65.0	54.0	53.5	56.0	51.2
Romania	230.4	160.1	111.7	119.4	89.8	68.4	62.4	67.6	64.0	57.4
Slovakia	64.6	43.6	39.4	46.1	40.8	35.2	29.8	33.7	29.7	28.3
Slovenia	14.5	13.8	12.6	13.4	12.6	17.4	11.6	11.7	11.3	10.5
Spain	250.5	287.0	337.3	389.2	306.1	280.3	218.7	235.8	241.7	218.9
Sweden	11.9	17.9	7.1	8.0	2.3	-2.0	6.6	11.1	10.6	13.2
EU-27	**4635**	**4248**	**4137**	**4199**	**3831**	**3495**	**3103**	**3269**	**3193**	**2908**

Notes: Due to an error in the aggregation of the waste subcategories in the Cypriot inventory, the sum of all Member States for 2020-2023 does not add up to the EU-27 value. There is a difference of approximately 0.4 Mt CO_2 equivalent.

The largest emitters in the EU inventory in 2023 were Germany (25 % of EU net emissions), followed by France, Italy and Poland. The majority of EU Member States contributed to the strong decrease in GHG emissions in the EU between 1990 and 2023, with Germany, Italy, France and Romania together accounting for 63 % of the total net reduction.

Common drivers to lower GHG emissions in most EU countries over the past 33 years have been the use of less carbon intensive fuels, with a switch from coal to gas and a strong increase in the use of renewable energy sources, as well as significant improvements in energy efficiency, both in transformation and end use.

More information on GHG emission trends by Member State can be found in the relevant national inventory reports to UNFCCC https://unfccc.int/ghg-inventories-annex-i-parties/2025.

2.5 Emission trends for indirect greenhouse gases and sulphur dioxide

Emissions of CO, NO_X, NMVOC and SO_2 have to be reported to the UNFCCC Secretariat because they influence climate change indirectly: CO, NO_X and NMVOC are precursor substances for ozone which itself is a greenhouse gas. Sulphur emissions produce microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation. Table 2.11 shows the total indirect GHG and SO_2 emissions in the EU between 1990 and 2023. All emissions were reduced significantly from 1990 levels.

Table 2.11 Overview of EU indirect GHG and SO2 emissions for 1990–2023 (kt)

	1990	1995	2000	2005	2010	2015	2020	2021	2022	2023
NO_x	13 829	11 937	10 657	9 984	8 060	6 839	5 199	5 268	5 103	4 712
CO	55 986	43 107	34 427	27 947	24 200	19 939	16 736	17 461	16 963	15 249
NMVOC	16 327	13 348	11 333	9 879	8 579	7 790	7 361	7 168	7 450	7 070
SO_2	18 000	11 016	6 940	5 451	3 027	2 209	1 307	1 383	1 450	1 135

3 ENERGY (CRT SECTOR 1)

This chapter starts with an overview on emission trends in CRT Sector 1 Energy. For each EU key category as well as other important subsector specific categories, overview tables are presented including the countries' contributions to the category in terms of level and trend. This chapter includes also, the reference approach, and international bunkers.

3.1 Overview of sector

CRT Sector 1 Energy comprises of the three sectors Fuel combustion activities (1.A), Fugitive emissions from fuels (1.B) and CO_2 Transport and storage (1.C). The energy sector contributes 76% to total GHG emissions and is the largest emitting sector in the EU. Total GHG emissions from this sector decreased by 37 % from 3742 Mt in 1990 to 2364 Mt in 2023 (Figure 3.1). In 2023, emissions increased by 9 % compared to 2022.

The most important energy-related gas is CO_2 that makes up 73 % of the total EU greenhouse gas emissions in 2023. CH_4 of the energy sector is responsible for 2 % and N_2O for 1 % of the total GHG emissions.

Figure 3.1 CRT Sector 1 Energy: EU GHG emissions in CO_2 equivalents (kt) for 1990–2023

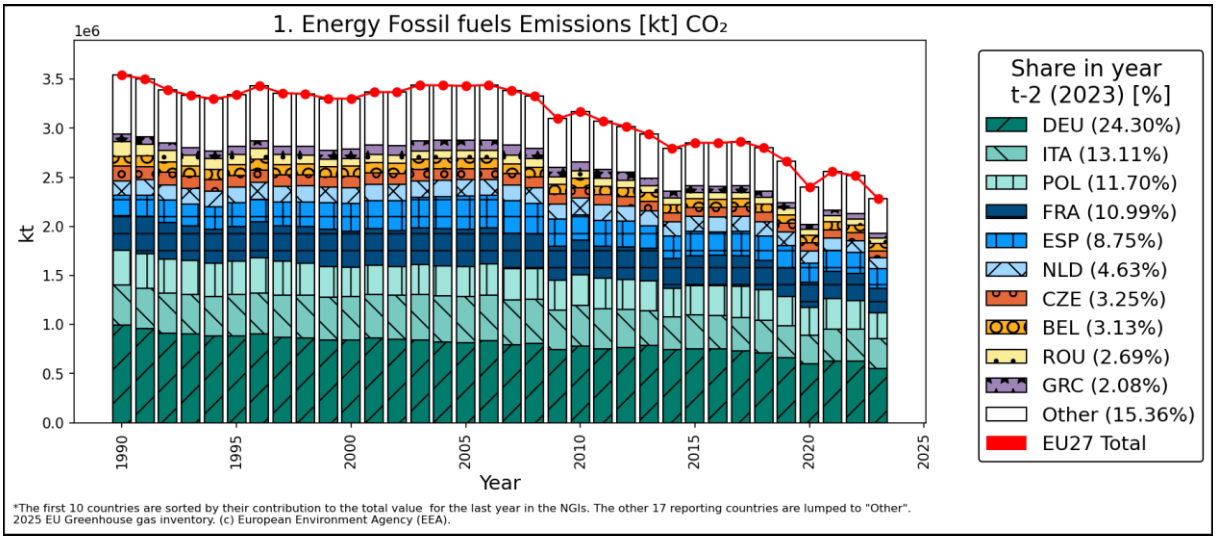


Table 3.1shows that CO_2 emissions from source categories 1.A.1.a – Public Electricity and Heat Production and 1.A.3.b – Road Transportation account for 57% from the whole Sector 1. Substantial decreases in absolute terms between 1990 and 2023 were reported in CO_2 emissions from sectors 1.A.1.a – Public Electricity and Heat Production and 1.A.2 – Manufacturing Industries and Construction, while CO_2 emissions from sector 1.A.3.b – Road Transportation increased by 23% in the same period.

Table 3.1 Sector 1 Energy: Share and change major categories and all remaining categories in 1990 and 2023 in the EU

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
1.A.3.b - Road Transportation - CO2	609764	749090	139	23%	32%
1.A.1.b - Petroleum Refining - CO2	107030	92901	-14	-13%	4%
1.A.4.a - Commercial/Institutional - CO2	169604	100644	-69	-41%	4%
1.A.4.b - Residential - CO2	426454	251588	-175	-41%	11%
1.A.2 - Manufacturing Industries and Construction - CO2	715454	358305	-357	-50%	15%
1.A.1.a - Public Electricity and Heat Production - CO2	1226218	567984	-658	-54%	24%
All other energy categories	485528	243443	-242	-50%	10%
Total Energy	**3740052**	**2363955**	**-1376**	**-37%**	**100%**

The key categories in the energy sector are as follows:

- 1.A.1.a. Public electricity and heat production: Gaseous Fuels (CO_2)
- 1.A.1.a. Public electricity and heat production: Liquid Fuels (CO_2)
- 1.A.1.a. Public electricity and heat production: Other Fuels (CO_2)
- 1.A.1.a. Public electricity and heat production: Peat (CO_2)
- 1.A.1.a. Public electricity and heat production: Solid Fuels (CO_2)
- 1.A.1.b. Petroleum refining: Gaseous Fuels (CO_2)
- 1.A.1.b. Petroleum refining: Liquid Fuels (CO_2)
- 1.A.1.c. Manufacture of solid fuels and other energy industries: Gaseous Fuels (CO_2)
- 1.A.1.c. Manufacture of solid fuels and other energy industries: Solid Fuels (CO_2)
- 1.A.2.a. Iron and steel: Gaseous Fuels (CO_2)
- 1.A.2.a. Iron and steel: Liquid Fuels (CO_2)
- 1.A.2.a. Iron and steel: Solid Fuels (CO_2)
- 1.A.2.b. Non-ferrous metals: Gaseous Fuels (CO_2)
- 1.A.2.c. Chemicals: Gaseous Fuels (CO_2)
- 1.A.2.c. Chemicals: Liquid Fuels (CO_2)
- 1.A.2.c. Chemicals: Solid Fuels (CO_2)
- 1.A.2.d. Pulp, paper and print: Gaseous Fuels (CO_2)
- 1.A.2.d. Pulp, paper and print: Liquid Fuels (CO_2)
- 1.A.2.d. Pulp, paper and print: Solid Fuels (CO_2)
- 1.A.2.e. Food processing, beverages and tobacco: Gaseous Fuels (CO_2)
- 1.A.2.e. Food processing, beverages and tobacco: Liquid Fuels (CO_2)
- 1.A.2.e. Food processing, beverages and tobacco: Solid Fuels (CO_2)
- 1.A.2.f. Non-metallic minerals: Gaseous Fuels (CO_2)
- 1.A.2.f. Non-metallic minerals: Liquid Fuels (CO_2)
- 1.A.2.f. Non-metallic minerals: Other Fuels (CO_2)
- 1.A.2.f. Non-metallic minerals: Solid Fuels (CO_2)
- 1.A.2.g. Other: Gaseous Fuels (CO_2)
- 1.A.2.g. Other: Liquid Fuels (CO_2)
- 1.A.2.g. Other: Other Fuels (CO_2)
- 1.A.2.g. Other: Solid Fuels (CO_2)
- 1.A.3.a. Domestic aviation: Jet Kerosene (CO_2)
- 1.A.3.b. Road transportation: Diesel Oil (CO_2)
- 1.A.3.b. Road transportation: Diesel Oil (N_2O)
- 1.A.3.b. Road transportation: Gaseous Fuels (CO_2)
- 1.A.3.b. Road transportation: Gasoline (CH_4)

- 1.A.3.b. Road transportation: Gasoline (CO_2)
- 1.A.3.b. Road transportation: Liquefied Petroleum Gases (LPG) (CO_2)
- 1.A.3.b. Road transportation: Other fuels (CO_2)
- 1.A.3.c. Railways: Liquid Fuels (CO_2)
- 1.A.3.d. Domestic navigation: Gas/Diesel Oil (CO_2)
- 1.A.3.d. Domestic navigation: Residual Fuel Oil (CO_2)
- 1.A.4.a. Commercial/institutional: Gaseous Fuels (CO_2)
- 1.A.4.a. Commercial/institutional: Liquid Fuels (CO_2)
- 1.A.4.a. Commercial/institutional: Other Fuels (CO_2)
- 1.A.4.a. Commercial/institutional: Solid Fuels (CO_2)
- 1.A.4.b. Residential: Biomass (CH_4)
- 1.A.4.b. Residential: Gaseous Fuels (CO_2)
- 1.A.4.b. Residential: Liquid Fuels (CO_2)
- 1.A.4.b. Residential: Solid Fuels (CH_4)
- 1.A.4.b. Residential: Solid Fuels (CO_2)
- 1.A.4.c. Agriculture/forestry/fishing: Gaseous Fuels (CO_2)
- 1.A.4.c. Agriculture/forestry/fishing: Liquid Fuels (CO_2)
- 1.A.4.c. Agriculture/forestry/fishing: Solid Fuels (CO_2)
- 1.A.5.a Stationary: Solid Fuels (CO_2)
- 1.A.5.b Mobile: Liquid Fuels (CO_2)

3.2 Overview of trends in the Energy sector

Figure 3.2 shows the contribution of the respective subcategories in the Energy sector to the EU trend for the years 1990-2023. Emissions in Energy sector decreased by 37% since 1990. This is mainly influenced by reductions of CO_2 emissions in sectors 1.A.1 (-52%), 1.A.2 (-50%) and 1.A.4 (-38%). Only sector 1.A.3 shows an increase of CO_2 emissions over the time (+18%). In 1990, 18% of emissions in the Energy sector were related to Transport, while in 2023 the share increased to 33%

All categories show a decreasing trend between 2022 and 2023 (Table 3.2)

Figure 3.2: Trend of categories in Energy sector

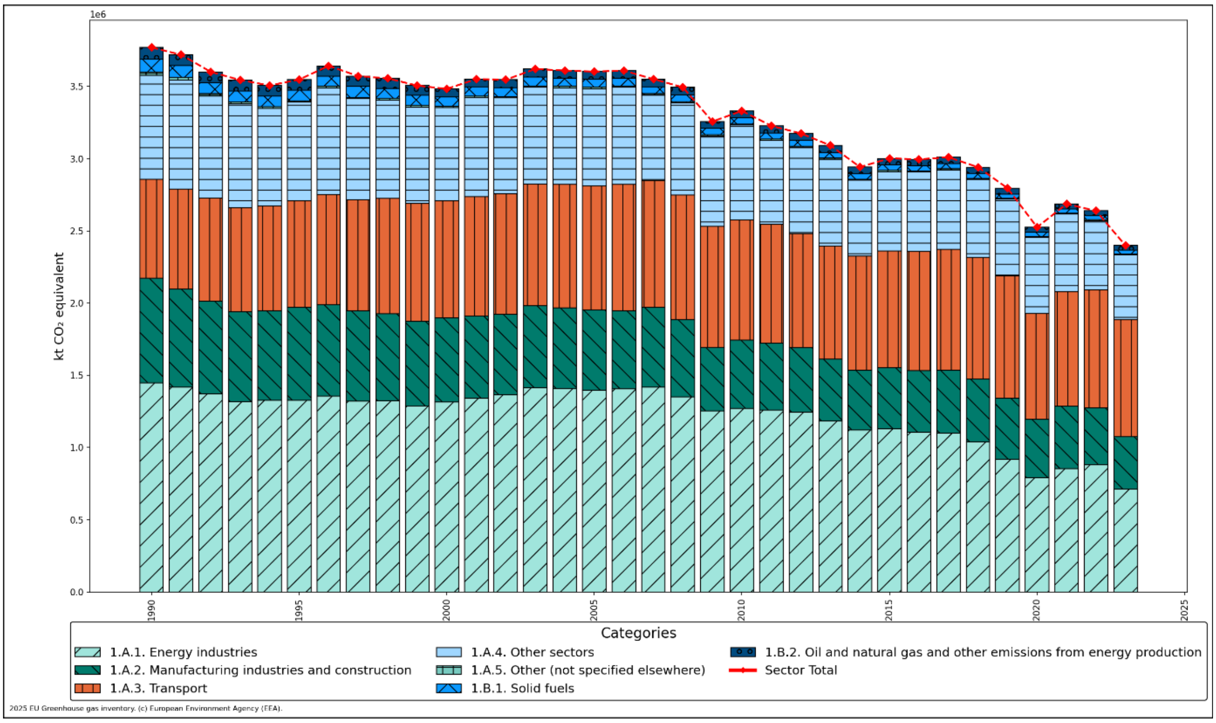


Table 3.2: Contribution of the different emission categories to the total trend in emissions from the energy sector

Emission category	Gas	Contribution to total energy emissions (2023)	Change of trend 1990-2023	Change of trend 2022-2023
1.A.1	CH_4	0.2%	231%	-5%
1.A.1	CO_2	29%	-52%	-19%
1.A.1	N_2O	0.2%	-32%	-18%
1.A.2	CH_4	0.1%	60%	-4%
1.A.2	CO_2	15%	-50%	-7%
1.A.2	N_2O	0.1%	-30%	-7%
1.A.3	CH_4	0.05%	-81%	-2%
1.A.3	CO_2	33%	19%	-1%
1.A.3	N_2O	0.3%	30%	-1%
1.A.4	CH_4	0.7%	-30%	-5%
1.A.4	CO_2	18%	-38%	-7%
1.A.4	N_2O	0.3%	-3%	-1%
1.A.5	CH_4	0.001%	-96%	-1%
1.A.5	CO_2	0.3%	-67%	4%
1.A.5	N_2O	0.002%	-74%	-1%
1.B.1	CH_4	0.9%	-73%	-7%
1.B.1	CO_2	0.1%	-56%	-6%
1.B.1	N_2O	0.00001%	106%	4%
1.B.2	CH_4	0.6%	-75%	-6%
1.B.2	CO_2	0.6%	-15%	-8%
1.B.2	N_2O	0.0%	-55%	-1%

3.3 Comparison between the sectoral approach and the reference approach

The IPCC reference approach for CO_2 from fossil fuels for the EU is based on Eurostat energy data for apparent consumption included in CRT table 1A(b) and data from MS CRT submissions for CRT table 1A(d). The reason for using Eurostat data in CRT table 1A(b) is that Eurostat provides a coherent data set for all Member States for apparent consumption in TJ whereas in the CRT submissions some MS use TJ and other MS use kt. Up to 2017 also for CRT table 1A(d) we used apparent consumption from Eurostat. The reason for having used Eurostat data in CRT table 1A(d) for many years was that also for non-energy use of fuels Eurostat provided a coherent data set for all EU Member States. The drawback of Eurostat data was that the definition of non-energy use of fuels in energy statistics is narrower than the definition in the IPCC guidelines because fuels used as reductants are not classified as non-energy use of fuels in energy statistics. In addition, Member States may use other data than the energy balance for compiling the non-energy use data (e.g. EU ETS data, environmental reporting of companies, etc.). Therefore, the EU decided to change the reporting in CRT table 1A(d) and calculate all data as the sum of respective MS data. The drawback of this approach is that Member States may use different allocation of energy use and non-energy use of fuels (e.g. in iron and steel) depending on the allocation in the sectoral approach.

Energy statistics are submitted to Eurostat by Member States on an annual basis with the five joint Eurostat/IEA/UNECE questionnaires on solid fuels, oil, natural gas, electricity and heat, and renewables and wastes. On the basis of this information Eurostat provides the annual energy balances which can be used for the estimation of CO_2 emissions from fossil fuels by Member State and for the EU as a whole.

The Eurostat data for the EU IPCC reference approach includes activity data and net calorific values as available in the Eurostat database. For the calculation of CO_2 emissions, the IPCC default carbon emission factors are used.

The IPCC reference approach method at EU level is a three-step process.

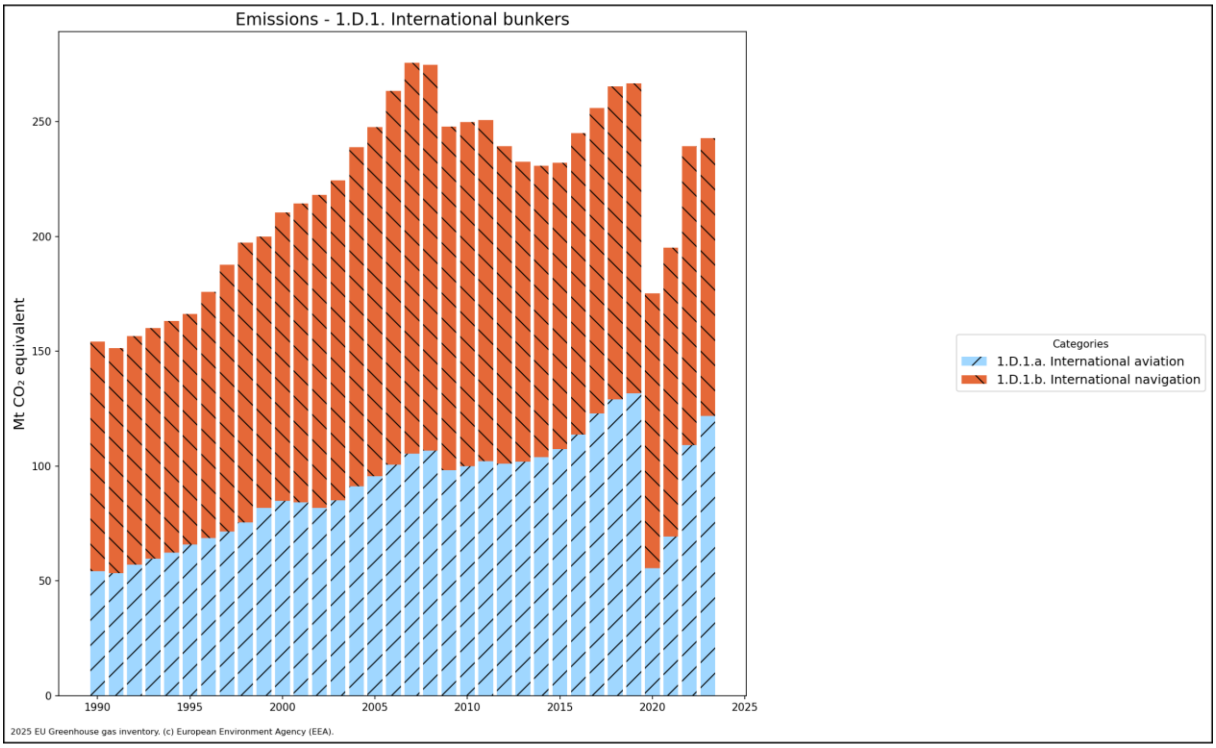
- The Energy Statistics Regulation (Regulation EC/1099/2008) is the basis for MS reporting of energy data to Eurostat as well as the basis for the EU's IPCC Reference Approach. For each of the EU Member States, annual data on energy production, imports, exports, international bunkers and stock changes by fuel are available from Eurostat's database http://ec.europa.eu/eurostat/data/database The energy data used for the Reference Approach in the EU inventory submission, and reported in table 1.A(b), corresponds to the sum of the EU Member States.
- The energy data in Eurostat's database can be exported in mass or volume units or in Terajoules. The latter is based on the calorific values reported by MS in the energy questionnaires, on a net basis. Table 1.A(b) was reported in Terajoules.
- The carbon emission factors are those from the IPCC 2006 Guidelines http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
- The carbon excluded from table 1.A(b) is fully consistent with the data included in table 1.A(d).
- Eurostat data is not used for table 1.A(d). Instead, we use the sum of the Member States CRT data because the definition of Eurostat non-energy use of fuels is narrower than in the IPCC guidelines and because the reporting in column I is closely linked to the inventories in IPPU sectors.
- The fractions of carbon oxidized reported in table 1.A(b) are the default 2006 IPCC factors of 1, thus assuming complete oxidation of emissions.

Note that in 2025 the reference approach tables (incl. feedstock tables) cannot be calculated due to persistent problems with the UNFCCC ETF tool.

3.4 International aviation (aviation bunkers) and international navigation (marine bunkers) (EU)

International bunker emissions include emissions from aviation and marine bunkers reported under CRT category 1.D.1. The EU emissions are derived as the sum of the international bunker emissions of the countries[23]. Between 1990 and 2023, total greenhouse gas emissions from international bunkers increased by 58 % in the EU. CO_2 emissions from marine bunkers accounted for 49.3 % of total greenhouse gas emissions from international bunkers in 2023, while from aviation bunkers 49.7 % (Figure 3.3).

Figure 3.3 1D1 International bunkers: Greenhouse gas emissions (in Mt of CO_2 equ.)



3.4.1 International Aviation (1D1a) (EU)

This mobile source category includes emissions from civil international aviation, i.e. passenger and freight activity of flights having their origin and destination (O-D) in different countries. The main fuel used is jet kerosene, while the use of aviation gasoline is almost negligible.

CO_2 emissions from 1D1a International Aviation

CO_2 emissions from international aviation accounted for 4 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only international aviation, CO_2 accounted for 99.2 % of total GHG emissions from international aviation in EU, 2023.

The time series of CO_2 emissions and activity data from 1D1a International aviation, years 1990-2023, are shown in Figure 3.4.

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[23] Specifically, what is considered as 'international bunker emissions' from the MS perspective, it is also considered from the perspective of the EU. Hence, the EU emissions are derived as the exact sum of emissions reported by the MS.

Figure 3.4 1D1a International Aviation: CO_2 emissions (in kt) and activity data (in TJ)

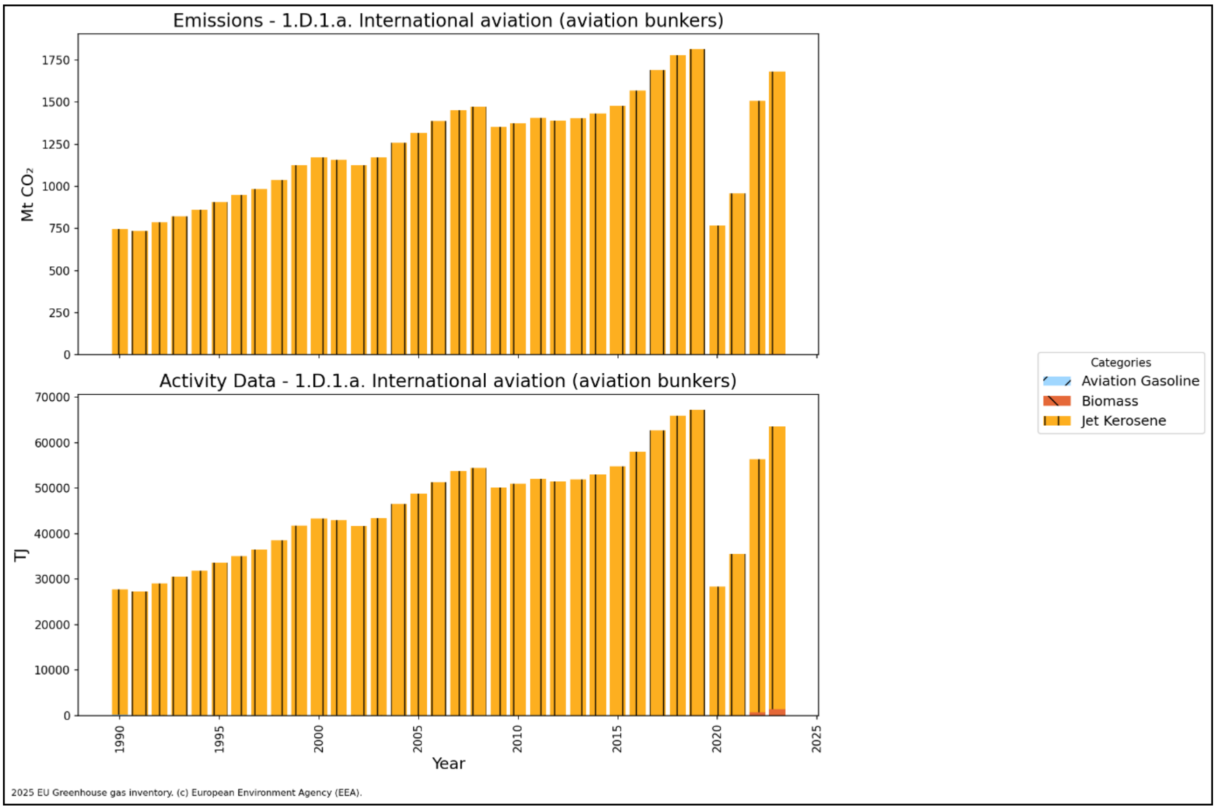


Table 3.3 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), and change between years for international aviation. Between 1990 and 2023, CO_2 emissions from international aviation increased by 125 % in the EU, while between 2022 and 2023 the corresponding change was 11 % increase.

Table 3.3 1D1a International Aviation bunkers: CO_2 emissions per country (in kt), share in EU (%), and change between years

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	880	1 967	2 634	2.2%	1 753	199%	667	34%
Belgium	3 125	5 257	5 270	4.3%	2 145	69%	13	0%
Bulgaria	713	592	660	0.5%	-53	-7%	68	11%
Croatia	497	564	596	0.5%	100	20%	32	6%
Cyprus	718	790	953	0.8%	235	33%	164	21%
Czechia	670	806	1 040	0.9%	370	55%	233	29%
Denmark	1 764	2 169	2 487	2.0%	723	41%	318	15%
Estonia	107	172	145	0.1%	38	36%	-27	-16%
Finland	1 008	1 630	1 923	1.6%	915	91%	294	18%
France	9 354	14 271	16 479	13.5%	7 125	76%	2 209	15%
Germany	12 027	27 186	28 387	23.3%	16 361	136%	1 201	4%
Greece	2 475	3 942	4 166	3.4%	1 691	68%	224	6%
Hungary	504	791	911	0.7%	406	81%	120	15%
Ireland	1 073	3 023	3 413	2.8%	2 340	218%	390	13%
Italy	4 285	9 107	11 603	9.5%	7 318	171%	2 495	27%
Latvia	221	434	407	0.3%	185	84%	-28	-6%
Lithuania	399	305	316	0.3%	-83	-21%	11	4%
Luxembourg	394	1 938	1 789	1.5%	1 395	354%	-148	-8%
Malta	197	379	469	0.4%	272	138%	90	24%
Netherlands	4 604	9 480	9 985	8.2%	5 381	117%	505	5%
Poland	640	2 891	3 525	2.9%	2 885	451%	634	22%
Portugal	1 533	4 105	4 774	3.9%	3 241	211%	669	16%
Romania	790	274	285	0.2%	-505	-64%	11	4%
Slovakia	67	131	152	0.1%	85	126%	21	16%
Slovenia	49	61	54	0.0%	5	10%	-7	-12%
Spain	4 741	15 007	17 210	14.1%	12 469	263%	2 203	15%
Sweden	1 355	1 937	2 112	1.7%	757	56%	175	9%
EU-27	**54 189**	**109 208**	**121 743**	**100%**	**67 553**	**125%**	**12 535**	**11%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period

1D1a International Aviation – Jet Kerosene (CO_2)

CO_2 emissions from jet kerosene accounted for 99.2 % of total GHG emissions from international aviation in 2023.

shows the time series of CO_2 emissions in EU from international aviation – jet kerosene and the highest shares of countries. *Figure 3.5* shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries (in t/TJ). It is observed that the CO_2 IEF at EU level is almost constant over the years at 72.5 t/TJ.

Figure 3.5: 1D1a International Aviation – Jet Kerosene: Time series of CO_2 emissions in EU and highest shares of countries

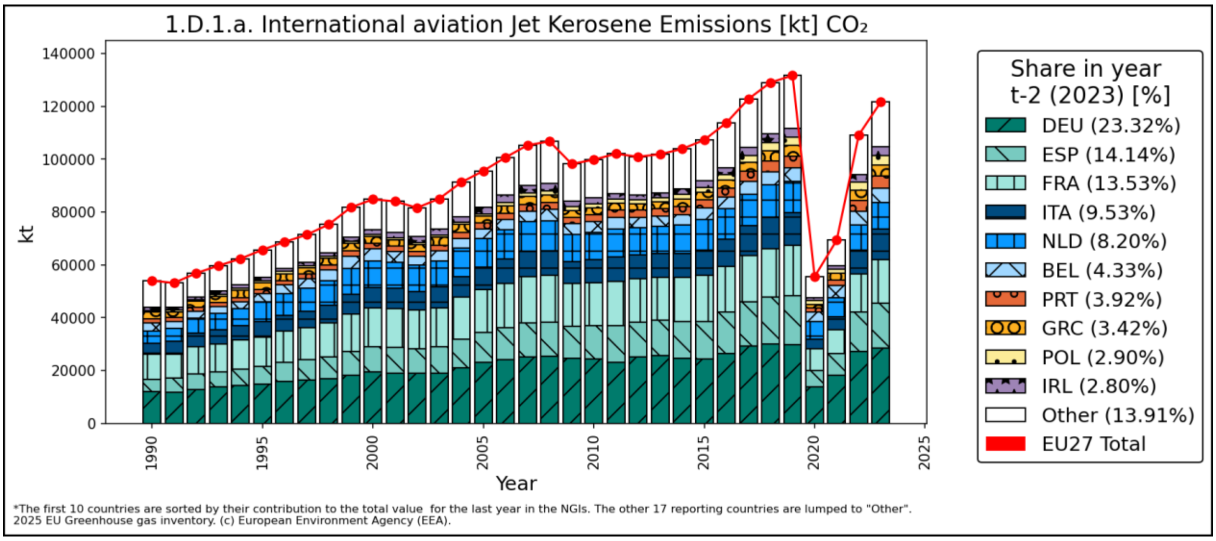
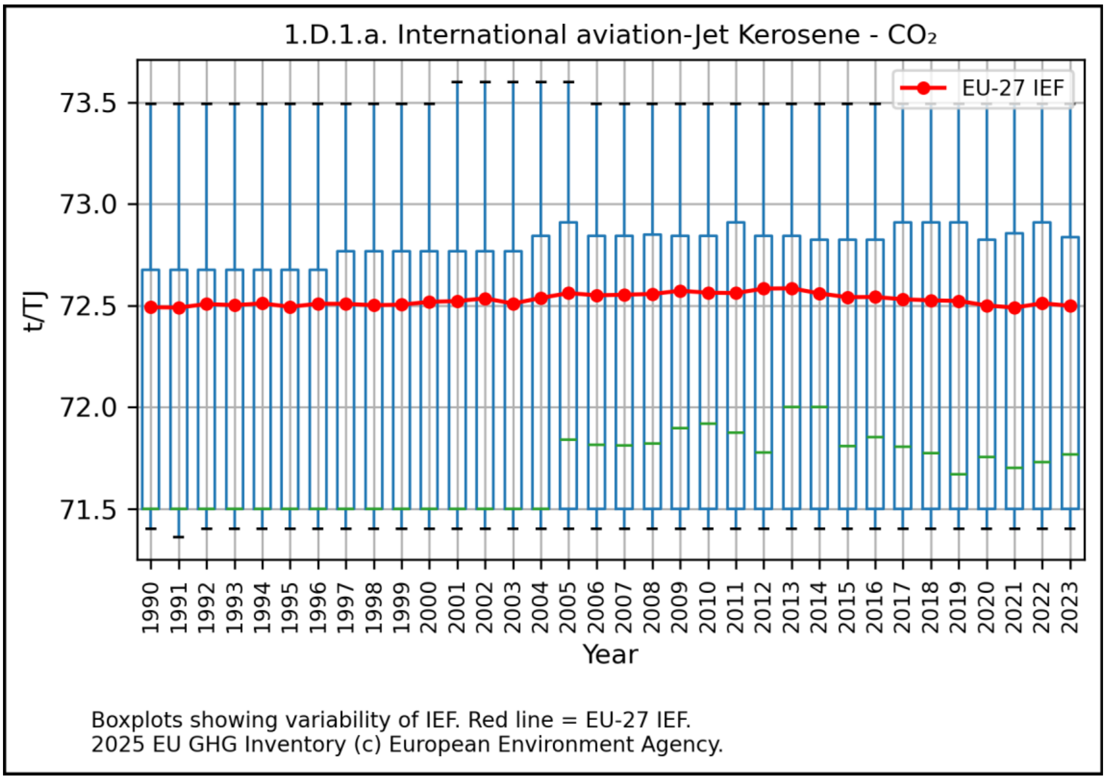


Figure 3.4: 1D1a International Aviation - Jet Kerosene: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



3.4.2 International Navigation (1D1b) (EU)

This mobile source category includes emissions from international waterborne transport, i.e. passenger and freight activity of trips having their origin and destination (O-D) in different countries. The main fuel used is residual fuel oil, followed by gas/diesel oil. Fishing vessels are excluded and they are reported separately under category 1A4ciii (Other sectors – Fishing).

CO_2 emissions from 1D1b International Navigation

CO_2 emissions from international navigation accounted for 4 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only international navigation, CO_2 accounted for 98.8 % of total GHG emissions from international navigation in EU, 2023.

The time series of CO_2 emissions and activity data from 1D1b International navigation, years 1990-2023, are shown in Figure 3.6.

Figure 3.6 1D1b International Navigation: CO_2 emissions (in kt) and activity data (in TJ)

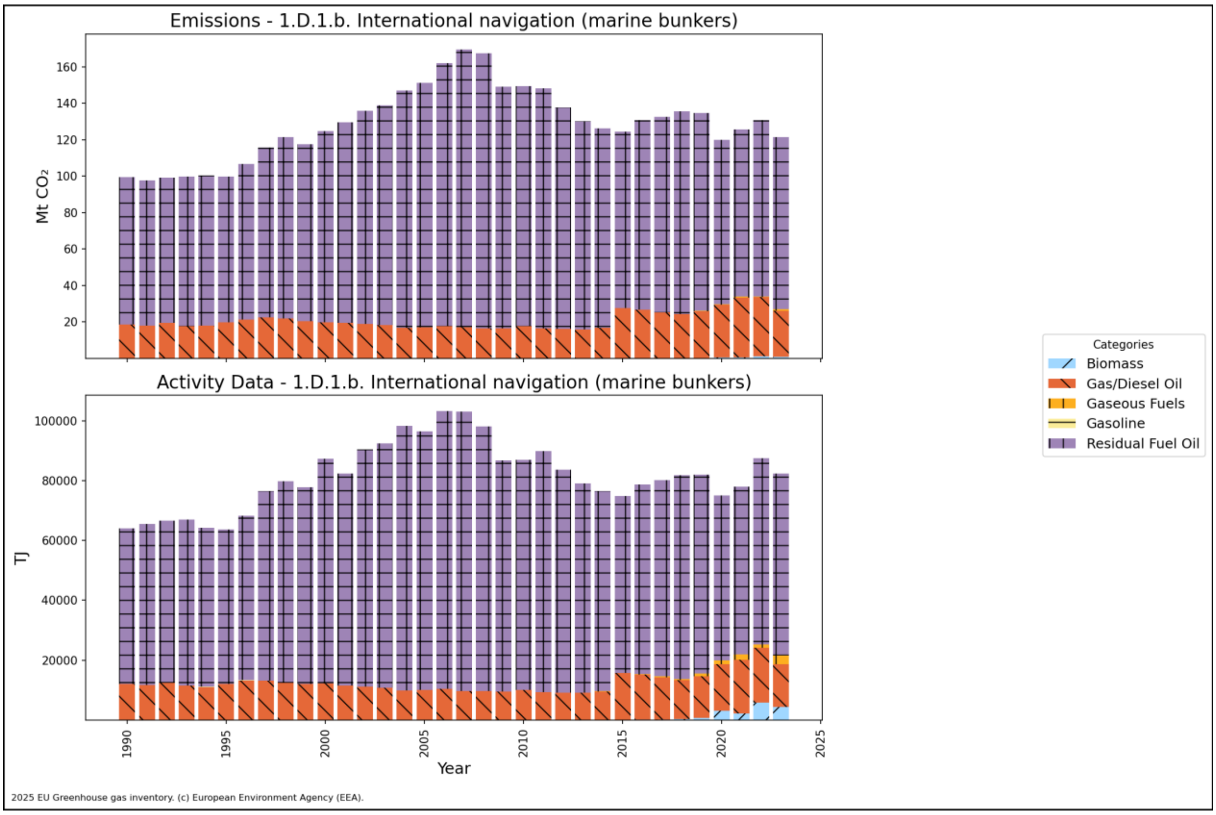


Table 3.4 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), and change between years for international navigation. Between 1990 and 2023, CO_2 emissions from international navigation increased by 21 % in the EU, while between 2022 and 2023 the corresponding change was 7 % decrease.

Table 3.4: 1D1b International Navigation: CO_2 emissions per country (in kt), share in EU (%), and change between years

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	46	32	30	0.0%	-16	-35%	-2	-7%
Belgium	13 313	24 572	22 237	18.4%	8 924	67%	-2 336	-10%
Bulgaria	183	211	206	0.2%	23	13%	-5	-2%
Croatia	147	59	73	0.1%	-74	-50%	14	23%
Cyprus	183	910	740	0.6%	557	305%	-170	-19%
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	3 014	1 554	1 606	1.3%	-1 408	-47%	52	3%
Estonia	573	937	722	0.6%	149	26%	-215	-23%
Finland	1 832	1 058	884	0.7%	-948	-52%	-174	-16%
France	6 763	3 708	3 375	2.8%	-3 388	-50%	-333	-9%
Germany	6 927	3 999	3 442	2.9%	-3 485	-50%	-557	-14%
Greece	8 106	6 376	6 545	5.4%	-1 561	-19%	169	3%
Hungary	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Ireland	57	403	413	0.3%	357	628%	10	3%
Italy	4 280	4 988	4 529	3.8%	250	6%	-459	-9%
Latvia	1 515	347	117	0.1%	-1 399	-92%	-231	-66%
Lithuania	302	485	384	0.3%	82	27%	-101	-21%
Luxembourg	0	0	0	0.0%	0	-65%	0	32%
Malta	895	6 826	7 225	6.0%	6 330	707%	399	6%
Netherlands	34 944	35 651	33 157	27.5%	-1 787	-5%	-2 494	-7%
Poland	1 265	855	822	0.7%	-443	-35%	-33	-4%
Portugal	1 400	2 233	1 804	1.5%	404	29%	-429	-19%
Romania	NO	52	67	0.1%	67	∞	15	28%
Slovakia	65	17	18	0.0%	-47	-72%	1	3%
Slovenia	NA,NO	NO	NO	-	-	-	-	-
Spain	11 587	27 671	27 025	22.4%	15 439	133%	-645	-2%
Sweden	2 333	6 859	5 334	4.4%	3 001	129%	-1 525	-22%
EU-27	**99 729**	**129 805**	**120 756**	**100%**	**21 027**	**21%**	**-9 049**	**-7%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period

1D1b International Navigation – Residual Fuel Oil (CO_2)

CO_2 emissions from residual fuel oil accounted for 77 % of total GHG emissions from international navigation in 2023.

Figure 3.7 shows the time series of CO_2 emissions in EU from international navigation – residual fuel oil and the highest shares of countries. *Figure 3.8* shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries (in t/TJ). It is observed that the CO_2 IEF at EU level is almost constant over the years at 77.6 – 77.7 t/TJ.

Figure 3.7 1D1b International Navigation – Residual Fuel Oil: Time series of CO_2 emissions in EU and highest shares of countries

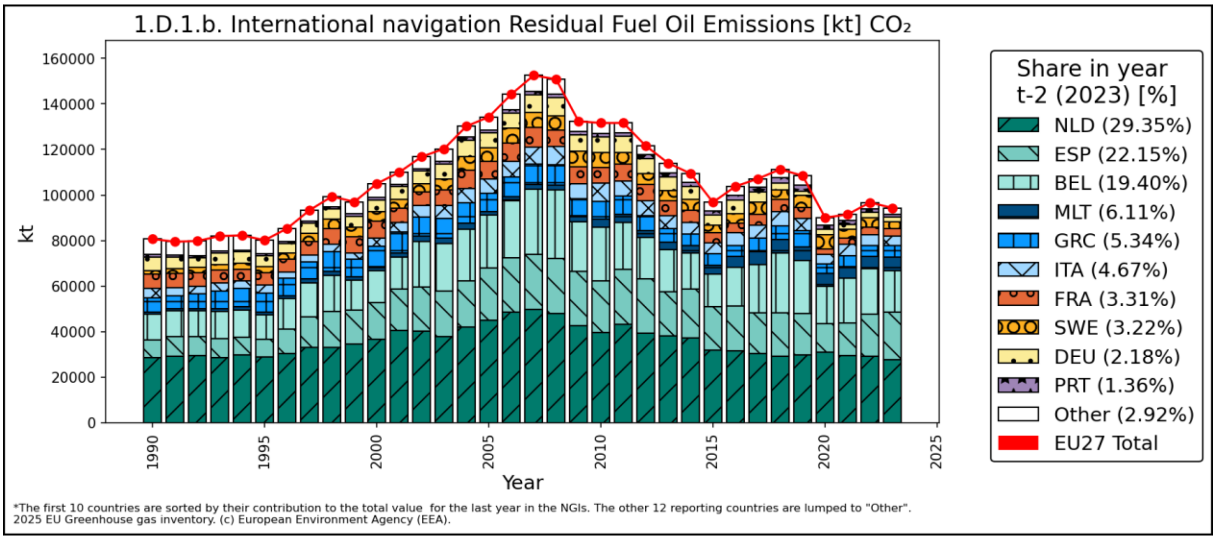
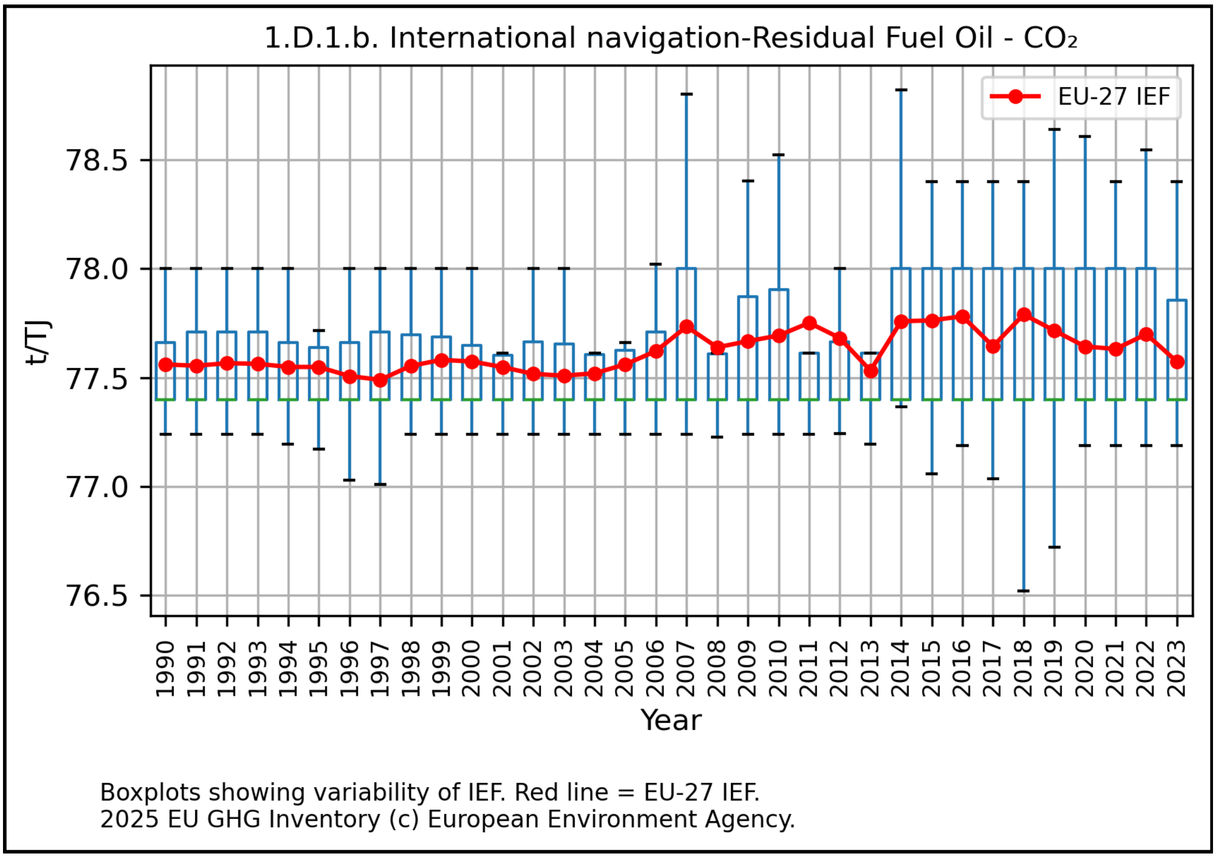


Figure 3.8 1D1b International Navigation – Residual Fuel Oil: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



1D1b International Navigation – Gas/Diesel Oil (CO_2)

CO_2 emissions from gas/diesel oil accounted for 20 % of total GHG emissions from international navigation in 2023.

*Figure **3.9*** shows the time series of CO_2 emissions in EU from international navigation – gas/diesel oil and the highest shares of countries. *Figure 3.10* shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries (in t/TJ). It is observed that the CO_2 IEF at EU level presents a small variation over the years ranging from 73.8 to 74.4 t/TJ.

Figure 3.9 1D1b International Navigation – Gas/Diesel Oil: Time series of CO_2 emissions in EU and highest shares of countries

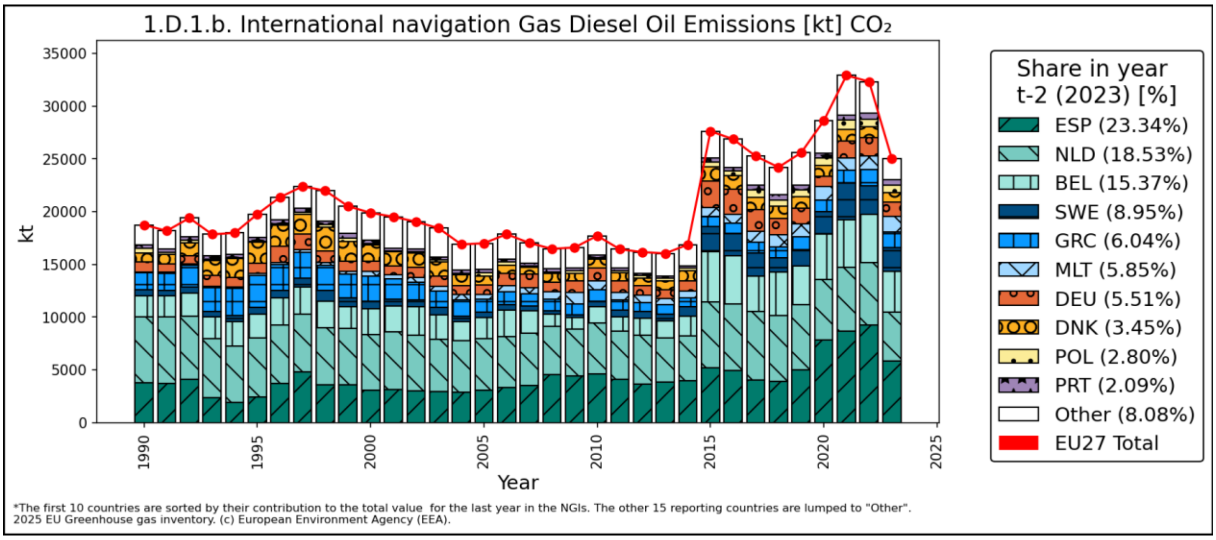
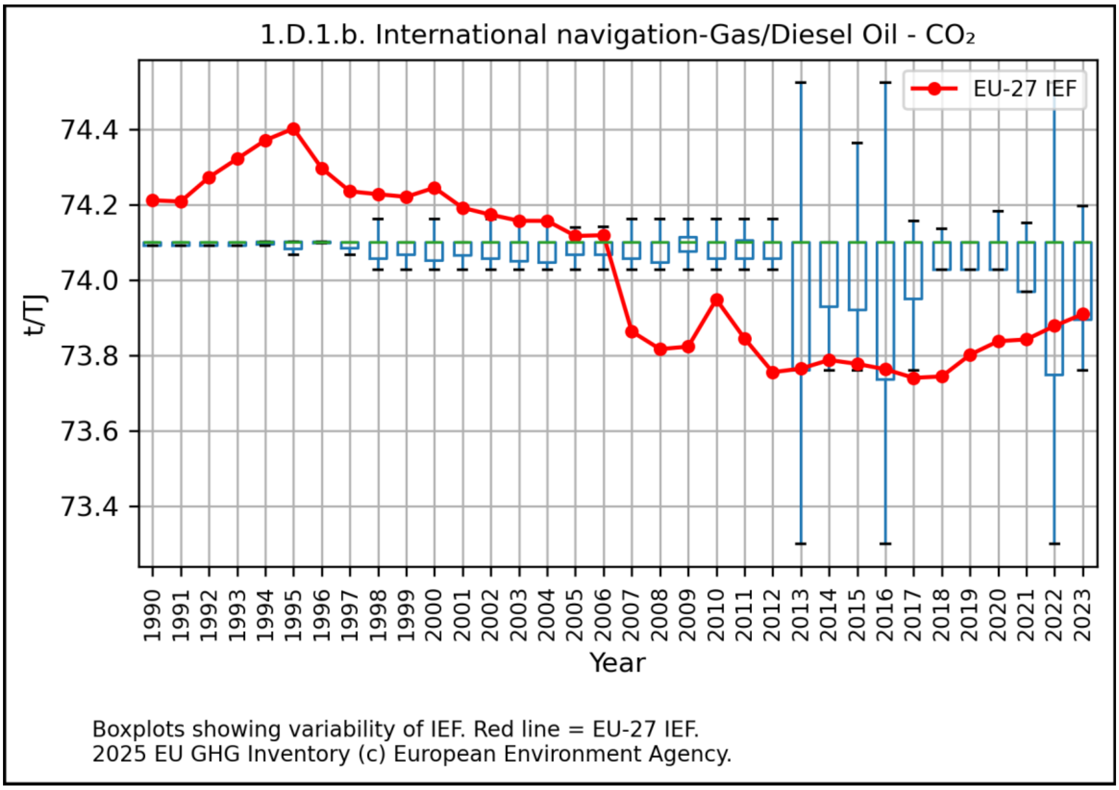


Figure 3.10: D1b International Navigation – Gas/Diesel Oil: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



3.5 Feedstocks and non-energy use of fuels

According to the 2006 IPCC guidelines non-energy fuels is divided into three categories:

(1) Raw materials for the chemical industry (Feedstocks). These fossil fuels are used in particular in the production of organic compounds and to a lesser extent in the production of inorganic chemicals (e.g. ammonia) and their derivatives. For organic substances, normally part of the carbon contained in the feedstock remains largely stored in these products. Typical examples of raw materials are feedstocks for the petrochemical industry (naphtha), natural gas, or different types of oils (e.g. the production of hydrogen for the subsequent production of ammonia by partial oxidation).
(2) Reductants. Carbon is used as a reductant in metallurgy and inorganic technologies. Unlike the previous case, here when using fossil fuel as reductant only a very small amount of carbon remains fixed in the products for a longer time and the larger part of the carbon is oxidized during the reduction process. Metallurgical coke is a typical reductant.
(3) Non-energy products. Non-energy products are materials derived from fuels in refineries or coke plants which, unlike the previous two cases, are used directly for their conventional physical properties, specifically as lubricants (lubricating oils and petrolatum), diluents and solvents, bitumen (for covering roads and roofs) and paraffin. Emissions of CO_2 and other GHG occur only to a limited extent in the IPPU category (e.g. during the oxidation of lubricants and paraffin). Substantial emissions occur during their recovery and during disposal by incineration (in the sector Energy and in Waste).

The non-energy use of fuels is reported in CRT table 1.A(d). The purpose of CRT table 1A(d) is twofold:

(1) The table should make transparent the amount of carbon from non-energy use of fuels that is subtracted from the carbon included in all fuels (both energy and non-energy use) in order to make a meaningful comparison between sectoral and reference approach.
(2) The table should make transparent in which categories other than Energy CO_2 emissions from non-energy use of fuels are included in the inventory (mostly IPPU). Therefore, the table serves as a basis for consistency checks with the IPPU sector reporting.

Note that in 2025 the reference approach tables (incl. feedstock tables) cannot be calculated due to persistent problems with the UNFCCC ETF tool.

3.6 Source categories

3.6.1 Energy Industries (CRT Source Category 1.A.1)

Energy Industries (CRT 1.A.1) comprises emissions from fuels combusted by the fuel extraction or energy-producing industries and is subdivided in three categories: Public electricity and heat production (CRT 1.A.1.a), Petroleum-refining (CRT 1.A.1.b), and Manufacture of solid fuels and other energy industries (CRT 1.A.1.c). Each category is described in its own chapter.

Table 3.5 shows the nine key categories of sector 1.A.1, including information on whether the reasons for this categorization lie in their emission trend and/or level. Furthermore, it entails information on the share of higher tier methods used by the countries. In sector 1.A.1.a Germany, Poland and Italy have mainly been influencing this share of higher tier methods because of their weight of emissions. The same applies to Italy, Germany and Spain in sector 1.A.1.b and Germany, Italy and Czechia in sector 1.A.1.c.

Many countries are using country specific information from the EU ETS and apply default emission factors for emissions that are not covered by the EU ETS. Similarly, countries may use country specific emission factors for the most common fuels and use default emission factors for fuels of minor importance. Therefore, countries might use apparently contradicting information such as "T1, T2" for Methods used and "CS, D" for Emission Factors applied. In such cases we assumed, that 90% of emissions are calculated using a higher tier method and 10% of emissions are calculated using the tier 1 method. When countries have reported country specific methods and emission factors it has been assumed, that a higher tier method has been used.

Table 3.5: Key source categories for level and trend analyses and share of MS emissions using higher tier methods in sector 1.A.1

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
1.A.1.a. Public electricity and heat production: Gaseous Fuels (CO_2)	107649	162489	T	L	L	99.0 %
1.A.1.a. Public electricity and heat production: Liquid Fuels (CO_2)	156323	22537	T	L	L	95.3 %
1.A.1.a. Public electricity and heat production: Other Fuels (CO_2)	10453	36123	T	L	L	95.6 %
1.A.1.a. Public electricity and heat production: Peat (CO_2)	9164	2560	T	L	0	99.2 %
1.A.1.a. Public electricity and heat production: Solid Fuels (CO_2)	942629	344275	T	L	L	96.4 %
1.A.1.b. Petroleum refining: Gaseous Fuels (CO_2)	5345	15411	T	0	L	98.5%
1.A.1.b. Petroleum refining: Liquid Fuels (CO_2)	97131	77001	T	L	L	97.4 %
1.A.1.c. Manufacture of solid fuels and other energy industries: Gaseous Fuels (CO_2)	8199	7218	0	L	L	95.6 %
1.A.1.c. Manufacture of solid fuels and other energy industries: Solid Fuels (CO_2)	88816	19266	T	L	L	96.4 %

Figure 3.11 shows the trends in emissions in Energy Industries for the EU between 1990 and 2023, which was mainly dominated by CO_2 emissions from public electricity and heat production. Carbon dioxide from 1.A.1.a currently represents about 85% of greenhouse gas emissions in 1.A.1 in 1990 (i.e. including methane and nitrous oxide) and around 81% in 2023.

Total greenhouse gas emissions from 1.A.1 decreased by 51.5%, between 1990 and 2023. This was mainly due to a decrease of CO_2eq emission from Public Electricity and Heat Production (-658 Mt CO_2eq) followed by -73 Mt CO_2eq of the manufacturing of solid fuels and -14 Mt CO_2eq from petroleum refining.

The decrease in fuel consumption since 2006 can be explained by the continuing effects of the economic downturn, the increased use of renewables, and also by enhanced energy efficiency in the newer EU Member States as well as mild winters. The reduction is particularly visible between 2019 and 2020 due to the COVID pandemic situation. Consumptions and emissions have increased again since 2021 but remain lower than the 2019 levels.

Figure 3.11 1.A.1 Energy Industries: Total GHG, emission trends and Activity Data

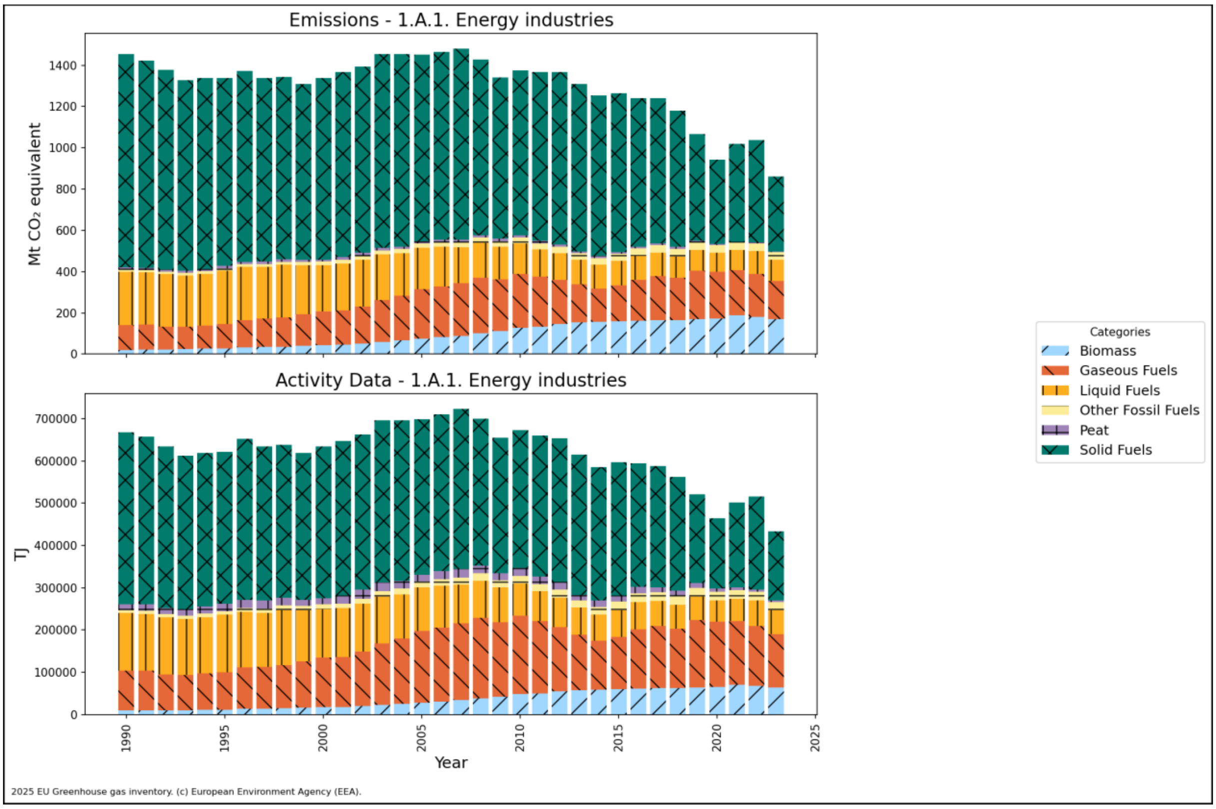


Table 3.6 breaks down the information by country. Between 1990 and 2023, greenhouse gas emissions from energy industries increased in two countries (Cyprus and Luxembourg) and fell in 25. The change in the EU was a net decrease of about 741.9 Mt CO_2eq or 51.5% in 33 years. The table shows the emissions of GHG, N_2O and CH_4 separately expressed in CO_2eq. The latter two greenhouse gases only contribute a very small part (combined approximately 1%) of the total emissions in energy industries.

Table 3.6 1.A.1 Energy industries: Countries' contributions to CO_2, N_2O and CH_4 emissions

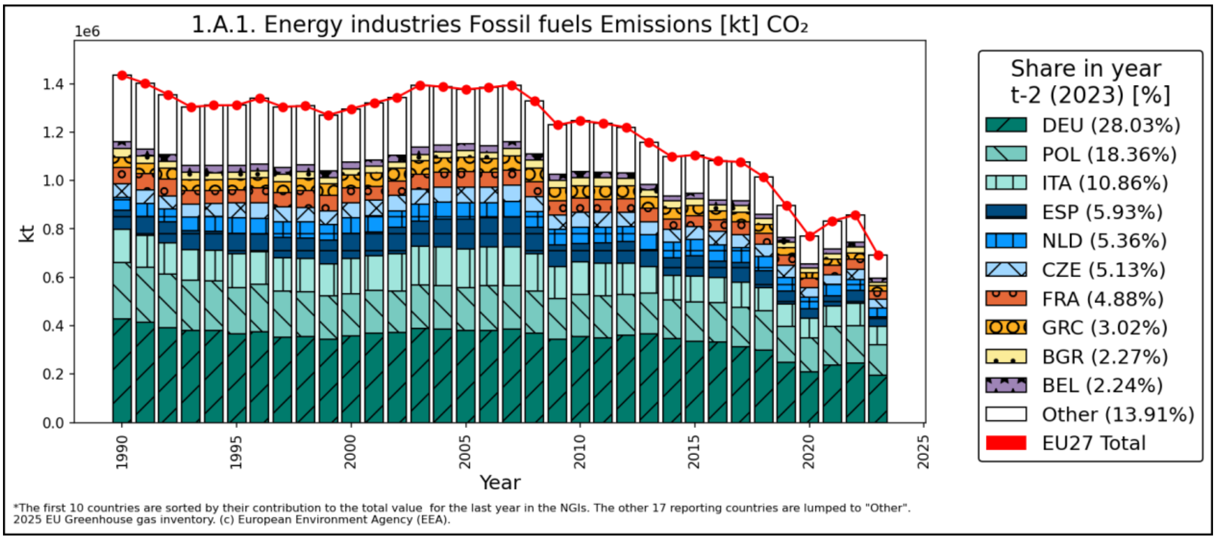
Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023	1990	2023
ıstria	14 008	7 292	13 961	7 182	37	83	9	27
elgium	29 677	15 613	29 496	15 519	159	60	22	34
ılgaria	36 526	15 768	36 401	15 672	111	74	15	22
oatia	7 087	4 097	7 066	4 054	15	29	6	14
/prus	1 767	3 060	1 761	3 050	4	6	2	3
zechia	56 830	35 662	56 594	35 467	218	160	19	35
enmark	26 249	6 548	26 156	6 390	76	66	17	92
stonia	28 285	5 472	28 269	5 423	13	29	3	20
nland	18 958	10 091	18 843	9 850	104	206	11	34
ance	66 304	34 017	65 822	33 776	399	184	83	58
ermany	431 083	198 062	427 953	193 854	2 816	1 482	314	2 726
reece	43 238	20 949	43 094	20 906	129	32	16	11
ıngary	20 866	9 255	20 796	9 196	60	37	11	22
eland	11 216	7 771	11 145	7 668	64	91	7	11
ıly	137 667	75 514	136 941	75 127	425	270	300	117
ıtvia	6 317	1 009	6 302	967	10	23	5	18
huania	13 552	2 407	13 522	2 337	18	39	11	31
ıxembourg	35	196	32	189	1	4	1	3
alta	1 765	800	1 759	799	5	0	1	0
etherlands	53 356	37 416	53 147	37 102	132	204	77	109
oland	235 233	127 571	234 298	127 012	905	530	30	30
ortugal	16 415	5 850	16 366	5 765	43	74	7	11
omania	71 655	15 532	71 448	15 475	164	46	43	10
ovakia	19 077	6 394	19 010	6 353	57	26	9	16
ovenia	6 374	3 310	6 350	3 291	23	15	2	4
oain	78 070	41 471	77 759	41 016	257	377	53	78
veden	9 858	8 423	9 746	8 189	99	172	12	62
J-27	**1 441 466**	**699 547**	**1 434 034**	**691 630**	**6 344**	**4 320**	**1 088**	**3 597**

Abbreviations are explained in the Chapter 'Units and abbreviations'

Public heat and electricity production is the main source of emissions from energy industries. Furthermore, it is the largest source category in the EU greenhouse gas inventory. Differences in the intensity of greenhouse gas emissions of heat and electricity production between the countries are to a large extent explained by the mix of fuels or technologies, which are used. Some countries rely more on coal than on gas. At the EU level, 34.3% of the fuel used in energy industries come from solid fuels. Its contribution has been declining in favour of the relatively cleaner natural gas, with about 31.0 in 2023. However, solid fuels represent the first source of energy in 2023. Biomass has been constantly increasing with a share of 16.0% in 2023.

The contribution of the MS can be seen in Figure 3.12.

Figure 3.12 1.A.1 Energy Industries, all fuels: Emission trend and share for CO_2



3.6.1.1 Public Electricity and Heat Production (1.A.1.a) (EU)

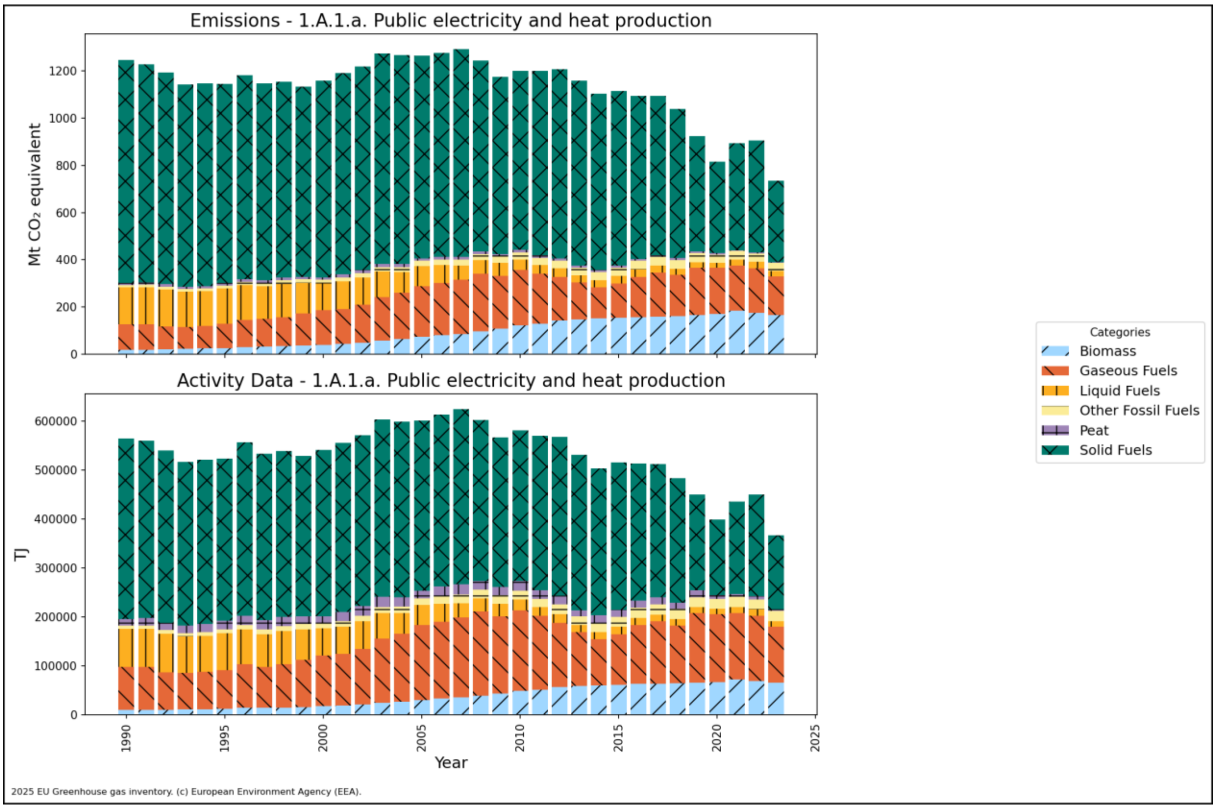
According to the 2006 IPCC guidelines, emissions from public electricity and heat production (CRT 1.A.1.a) should include emissions from main activity producers of electricity generation, combined heat and power generation, and heat plants. Main activity producers (i.e. public utilities) are defined as those undertakings whose primary activity is to supply the public. They may be in public or private ownership. Emissions from own on-site use of fuel should be included. Emissions from autoproducers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity that supports their primary activity) should be assigned to the sector where they were generated and not under 1.A.1.a. autoproducers may be in public or private ownership.

CO_2 emissions from electricity and heat production is the largest key category in the EU accounting for 19.5% of total greenhouse gas emissions in 2023 and for about 81% of greenhouse gas emissions of the Energy Industries Sector. Between 1990 and 2023, CO_2 emissions from electricity and heat production decreased by 54% in the EU.

Figure 3.13 shows the trends in emissions originating from the production of public electricity and heat by fuel in the EU between 1990 and 2023 as well as the underlying activity data[24].

[24] CO_2 emissions from the combustion of biomass fuels are reported as a memo item and are therefore not included in the emissions from public electricity and heat production. The biomass used as a fuel is however included in the national energy consumption (i.e. activity data). The fact that CO_2 emissions from biomass are treated differently from other fuel emissions does not imply emissions from the production of heat and electricity are due to fossil fuel combustion only. Biomass CO_2 emissions are just reported elsewhere. Non-CO_2 emissions from the combustion of biomass (CH_4 and N_2O) are reported under the energy sector.

Figure 3.13 1.A.1.a Public Electricity and Heat Production: Total emission and activity data trends



Fuel used for public electricity and heat production decreased by 36.9% in the EU between 1990 and 2023. Solid fuels represent 38.8% of the fuel used in public conventional thermal power plants; its combustion has been declining by 64% between 1990 and 2023. Gaseous fuels have increased very rapidly, by a factor of almost 3 between 1990 and 2010, declined until 2014 and now see a new increased use until 2019. In 2023 natural gas represents a share of 33.5% of all the fuels used for the production of heat and electricity in the EU. Liquid fuels still account for some 3.5%, but its use has declined gradually since 1990. The use of biomass has increased even more rapidly than the use of gas: its share in the fuel mix is now around 19.2%. Finally, other fossil fuels consumptions have been multiplied by almost 4 between 1990 and 2023 and represent 4.7% of total consumptions. Peat remains marginal with a share of 0.3% in 2023.

Carbon dioxide emissions amount to 98.7% of greenhouse gas emissions from public electricity and heat production. The change in the EU between 1990 and 2023 was a net decrease of 658.2 Mt CO_2 respectively of 54%. Table 3.7 shows emissions arising from the production of public heat and electricity by country.

Table 3.7 1.A.1.a Public Electricity and Heat Production: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	11 056	5 595	4 447	0.8%	-6 609	-60%	-1 148	-21%	NA,T2	CS,NA
Belgium	23 173	13 296	10 836	1.9%	-12 337	-53%	-2 459	-18%	NA,T1,T3	D,NA,PS
Bulgaria	35 179	25 838	14 713	2.6%	-20 466	-58%	-11 125	-43%	NA,T1,T2	CS,D,NA
Croatia	3 729	3 061	3 023	0.5%	-706	-19%	-38	-1%	NA,T1,T2	CS,D,NA
Cyprus	1 676	3 099	3 050	0.5%	1 374	82%	-49	-2%	CS,NA	CS,NA
Czechia	54 585	40 440	33 526	5.9%	-21 059	-39%	-6 913	-17%	NA,T1,T2	CS,D,NA
Denmark	24 717	6 228	4 660	0.8%	-20 058	-81%	-1 569	-25%	NA	NA
Estonia	28 191	7 028	3 663	0.6%	-24 528	-87%	-3 365	-48%	T1,T2,T3	CS,D,PS
Finland	16 453	10 908	8 034	1.4%	-8 419	-51%	-2 874	-26%	NA,T3	CS,D,NA,PS
France	49 148	33 277	26 123	4.6%	-23 025	-47%	-7 154	-21%	T2,T3	CS,D,OTH,PS
Germany	338 451	215 498	165 578	29.2%	-172 873	-51%	-49 920	-23%	CS	CS
Greece	40 617	18 837	15 335	2.7%	-25 282	-62%	-3 502	-19%	NA,T2	NA,PS
Hungary	17 850	8 968	7 404	1.3%	-10 446	-59%	-1 564	-17%	NA,T1,T2,T3	CS,D,NA,PS
Ireland	10 876	9 424	7 348	1.3%	-3 529	-32%	-2 076	-22%	T1,T3	CS,D,PS
Italy	108 670	71 388	53 571	9.4%	-55 099	-51%	-17 817	-25%	T3	CS
Latvia	6 097	908	904	0.2%	-5 193	-85%	-4	0%	NA,T2	CS,NA
Lithuania	12 003	1 136	925	0.2%	-11 078	-92%	-211	-19%	NA,T1,T2,T3	CS,D,NA,PS
Luxembourg	32	221	189	0.0%	156	481%	-32	-15%	NA,T2	CS,NA
Malta	1 759	796	799	0.1%	-960	-55%	2	0%	NA,T2	CS,NA
Netherlands	40 026	33 158	26 202	4.6%	-13 824	-35%	-6 956	-21%	CS,NA,T2	CS,NA
Poland	227 279	145 093	119 080	21.0%	-108 200	-48%	-26 013	-18%	NA,T1,T2	CS,D,NA
Portugal	14 355	6 728	4 393	0.8%	-9 962	-69%	-2 335	-35%	T1,T2,T3	D,PS
Romania	67 020	14 988	12 585	2.2%	-54 435	-81%	-2 403	-16%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	14 700	3 286	3 203	0.6%	-11 497	-78%	-83	-3%	NA,T2	CS,NA
Slovenia	6 096	3 400	3 291	0.6%	-2 805	-46%	-109	-3%	NA,T1,T2,T3	CS,D,NA,PS
Spain	64 812	42 069	30 378	5.3%	-34 434	-53%	-11 692	-28%	NA,T1,T2	CS,NA,PS
Sweden	7 668	4 786	4 725	0.8%	-2 943	-38%	-61	-1%	T2	CS
EU-27	**1 226 218**	**729 454**	**567 984**	**100%**	**-658 234**	**-54%**	**-161 470**	**-22%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period Abbreviations are explained in the Chapter 'Units and abbreviations'.

N_2O emissions currently represent 0.7 % of greenhouse gas emissions from public electricity and heat production. Between 1990 and 2023, emissions decreased by 26% (Table 3.8).

Table 3.8 1.A.1.a Public Electricity and Heat Production: Countries' contributions to N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	35	83	80	2.0%	45	129%	-2	-3%	NA,T1	D,NA
Belgium	45	57	44	1.1%	-1	-2%	-13	-23%	NA,T1,T3	D,NA
Bulgaria	109	120	73	1.9%	-36	-33%	-47	-39%	NA,T1	D,NA
Croatia	12	28	28	0.7%	16	139%	0	-1%	NA,T1	D,NA
Cyprus	3	6	6	0.2%	3	84%	0	-2%	NA,T1	D,NA
Czechia	215	187	155	3.9%	-61	-28%	-32	-17%	NA,T1	D,NA
Denmark	70	63	61	1.6%	-9	-13%	-2	-3%	NA	NA
Estonia	13	27	27	0.7%	15	116%	0	0%	T1,T2	CS,D
Finland	89	215	190	4.8%	101	113%	-25	-11%	NA,T3	CS,NA
France	373	197	180	4.6%	-193	-52%	-17	-9%	T1,T2,T3	D,PS
Germany	2 141	1 639	1 319	33.6%	-822	-38%	-319	-19%	T2	CS
Greece	126	35	28	0.7%	-98	-78%	-7	-21%	NA,T1	D,NA
Hungary	56	44	35	0.9%	-21	-37%	-8	-19%	NA,T1	D,NA
Ireland	63	102	91	2.3%	28	45%	-11	-11%	T1,T2	D
Italy	273	198	141	3.6%	-133	-49%	-57	-29%	T3	CR,D
Latvia	10	24	23	0.6%	13	137%	-1	-6%	NA,T1	D,NA
Lithuania	17	37	38	1.0%	21	130%	1	2%	NA,T1	D,NA
Luxembourg	1	4	4	0.1%	3	198%	0	1%	NA,T1	D,NA
Malta	5	0	0	0.0%	-5	-92%	0	-12%	NA,T1	D,NA
Netherlands	118	229	185	4.7%	67	57%	-44	-19%	D,NA,T1	D,NA
Poland	891	624	522	13.3%	-369	-41%	-101	-16%	NA,T1	D,NA
Portugal	41	108	73	1.9%	32	80%	-34	-32%	T1	D
Romania	160	58	43	1.1%	-117	-73%	-15	-25%	NA,T1	D,NA
Slovakia	52	23	23	0.6%	-29	-56%	0	-1%	NA,T1	D,NA
Slovenia	22	15	15	0.4%	-7	-33%	0	-3%	NA,T1	D,NA
Spain	244	531	371	9.4%	127	52%	-161	-30%	NA,T2	D,NA,OTH
Sweden	98	173	169	4.3%	71	73%	-4	-2%	T2	CS
EU-27	**5 283**	**4 828**	**3 925**	**100%**	**-1 358**	**-26%**	**-903**	**-19%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Finally, CH_4 emissions currently represent 0.6% of greenhouse gas emissions from public electricity and heat production. Between 1990 and 2023, emissions increased by 460% (Table 3.5).

Table 3.9 1.A.1.a Public Electricity and Heat Production: Countries' contributions to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	7	25	24	0.7%	17	256%	-1	-4%	NA,T1,T2	CS,D,NA
Belgium	13	32	30	0.9%	17	136%	-2	-6%	NA,T1,T3	D,NA
Bulgaria	14	28	21	0.6%	7	53%	-6	-24%	NA,T1	D,NA
Croatia	4	14	14	0.4%	10	264%	0	0%	NA,T1	D,NA
Cyprus	2	3	3	0.1%	1	81%	0	-2%	NA,T1	D,NA
Czechia	17	40	34	1.0%	17	97%	-6	-15%	NA,T1	D,NA
Denmark	16	103	91	2.7%	75	455%	-12	-11%	NA	NA
Estonia	3	16	18	0.6%	16	542%	2	12%	T1,T2	CS,D
Finland	10	35	34	1.0%	24	236%	-2	-6%	NA,T3	CS,NA
France	15	58	53	1.6%	37	246%	-5	-9%	T1,T2,T3	CS,D
Germany	193	2 693	2 596	77.7%	2 403	1246%	-97	-4%	T2	CS
Greece	14	9	8	0.2%	-6	-43%	-1	-13%	NA,T1	D,NA
Hungary	8	26	21	0.6%	12	152%	-5	-21%	NA,T1	D,NA
Ireland	7	12	11	0.3%	3	47%	-1	-8%	T1,T2	D
Italy	106	111	88	2.6%	-19	-18%	-23	-21%	T3	CR,D
Latvia	5	19	18	0.5%	13	247%	-1	-6%	NA,T1	D,NA
Lithuania	10	29	30	0.9%	20	200%	1	2%	NA,T1	D,NA
Luxembourg	1	3	3	0.1%	2	199%	0	1%	NA,T1	D,NA
Malta	1	0	0	0.0%	-1	-69%	0	-5%	NA,T1	D,NA
Netherlands	44	108	91	2.7%	47	108%	-17	-16%	NA,T1,T2	CS,D,NA
Poland	22	26	25	0.7%	2	10%	-1	-6%	NA,T1,T2	CS,D,NA
Portugal	5	12	10	0.3%	6	123%	-2	-15%	T1	D
Romania	40	12	8	0.2%	-32	-80%	-4	-31%	NA,T1	D,NA
Slovakia	7	14	14	0.4%	7	111%	0	0%	NA,T1	D,NA
Slovenia	2	4	4	0.1%	2	79%	0	0%	NA,T1	D,NA
Spain	19	51	44	1.3%	24	125%	-8	-15%	NA,T2	CR,CS,D,NA
Sweden	12	52	51	1.5%	39	339%	-1	-2%	T2	CS
EU-27	**597**	**3 535**	**3 342**	**100%**	**2 745**	**460%**	**-193**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

1.A.1.a Electricity and Heat Production - Liquid Fuels (CO_2)

CO_2 emissions arising from the combustion of liquid fuels for public electricity and heat generation account for about 3.9% of all greenhouse gas emissions from 1.A.1.a. Within the EU, emissions fell by 86% respectively by 133.7 Mt CO_2 between 1990 and 2023 (Table 3.10).

Table 3.10 1.A.1.a Public Electricity and Heat Production, Liquid Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	1 229	236	147	0.7%	-1 082	-88%	-89	-38%
Belgium	644	40	44	0.2%	-601	-93%	4	9%
Bulgaria	3 245	109	54	0.2%	-3 191	-98%	-55	-50%
Croatia	2 142	64	15	0.1%	-2 127	-99%	-48	-76%
Cyprus	1 676	3 099	3 050	13.5%	1 374	82%	-49	-2%
Czechia	1 174	127	122	0.5%	-1 051	-90%	-5	-4%
Denmark	953	322	132	0.6%	-821	-86%	-190	-59%
Estonia	3 519	128	106	0.5%	-3 412	-97%	-22	-17%
Finland	1 234	1 186	825	3.7%	-409	-33%	-362	-30%
France	8 209	4 022	3 601	16.0%	-4 608	-56%	-421	-10%
Germany	8 637	1 671	1 188	5.3%	-7 449	-86%	-483	-29%
Greece	5 416	3 248	3 089	13.7%	-2 327	-43%	-159	-5%
Hungary	1 443	42	31	0.1%	-1 412	-98%	-11	-26%
Ireland	1 087	833	180	0.8%	-906	-83%	-653	-78%
Italy	64 597	1 982	1 188	5.3%	-63 409	-98%	-794	-40%
Latvia	3 079	64	57	0.3%	-3 022	-98%	-7	-11%
Lithuania	6 021	273	243	1.1%	-5 779	-96%	-30	-11%
Luxembourg	NO	2	1	0.0%	1	∞	-1	-35%
Malta	1 049	49	16	0.1%	-1 033	-98%	-32	-66%
Netherlands	233	462	303	1.3%	70	30%	-159	-34%
Poland	5 198	1 636	1 380	6.1%	-3 817	-73%	-256	-16%
Portugal	6 434	702	737	3.3%	-5 697	-89%	35	5%
Romania	20 441	310	334	1.5%	-20 107	-98%	24	8%
Slovakia	1 033	9	8	0.0%	-1 025	-99%	-1	-12%
Slovenia	272	79	12	0.1%	-260	-96%	-67	-85%
Spain	6 081	5 548	5 672	25.2%	-409	-7%	124	2%
Sweden	1 277	C	C	-	-1 277	-100%	-	-
EU-27	**156 323**	**26 242**	**22 537**	**100%**	**-133 786**	**-86%**	**-3 706**	**-14%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'. The information on methodologies and emission factors is not available from the JSON on fuels level Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.14 shows the contribution to the emission trend for liquid fuels by the main countries.

Figure 3.14 1.A.1.a Public Electricity and Heat Production, Liquid Fuels: Emission trend and share for CO_2

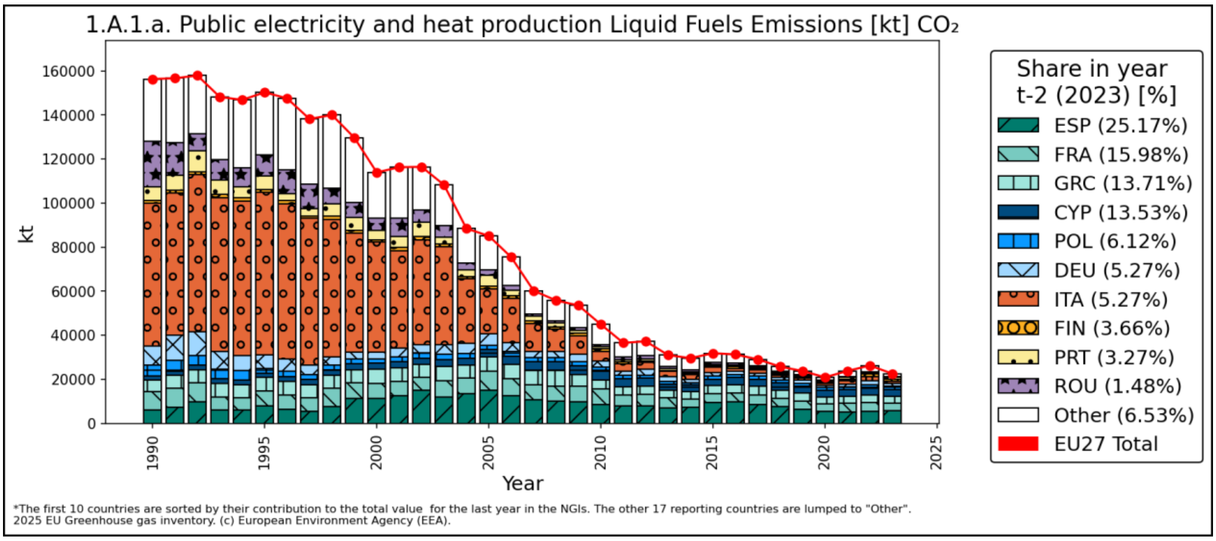
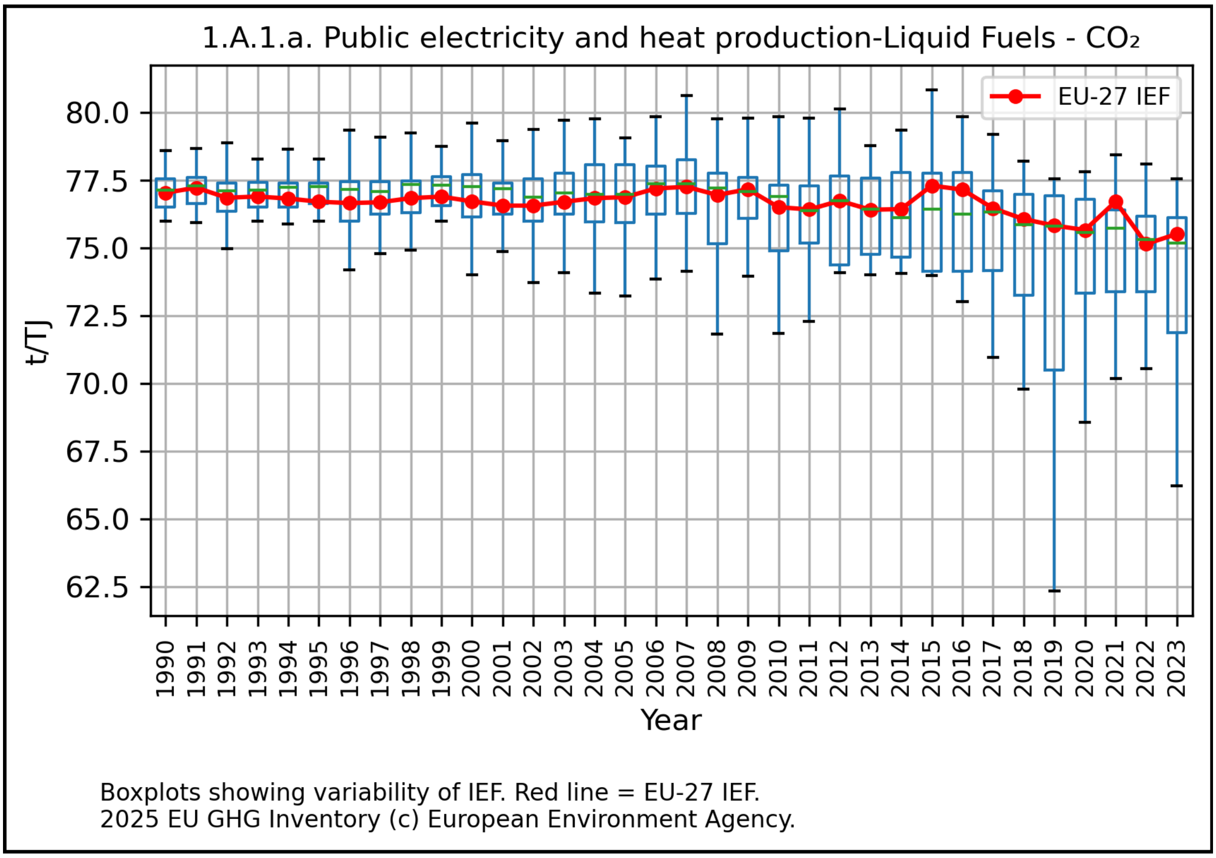


Figure 3.15 shows the implied emission factors for CO_2 emissions from liquid fuels used in public electricity and heat production. The IEFs in most countries range between 76 and 78 t/TJ on the entire time-series. The average IEF within the EU is 75.5 t/TJ in 2023.

Figure 3.15 1.A.1.a Public Electricity and Heat Production, Liquid Fuels: Implied Emission Factors for CO_2



1.A.1.a Electricity and Heat Production - Solid Fuels (CO_2)

CO_2 emissions from the combustion of solid fuels represented about 59.8% of all greenhouse gas emissions from public electricity and heat production. Within the EU, emissions fell by 63% between 1990 and 2023 (Table 3.11). A reason for the recent decline is that coal is being phased out of the fuel mix.

Table 3.11 1.A.1.a Public Electricity and Heat Production, Solid Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	6 247	NO	NO	-	-6 247	-100%	-	-
Belgium	19 148	5 051	4 025	1.2%	-15 123	-79%	-1 026	-20%
Bulgaria	25 638	23 894	12 923	3.8%	-12 714	-50%	-10 970	-46%
Croatia	595	1 267	1 082	0.3%	487	82%	-185	-15%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	52 368	37 261	30 577	8.9%	-21 791	-42%	-6 684	-18%
Denmark	22 225	3 766	2 323	0.7%	-19 902	-90%	-1 442	-38%
Estonia	22 017	6 481	3 172	0.9%	-18 845	-86%	-3 309	-51%
Finland	9 281	5 214	3 468	1.0%	-5 812	-63%	-1 745	-33%
France	37 412	7 385	4 171	1.2%	-33 240	-89%	-3 214	-44%
Germany	307 246	170 722	121 659	35.3%	-185 587	-60%	-49 063	-29%
Greece	35 201	8 251	6 074	1.8%	-29 127	-83%	-2 176	-26%
Hungary	12 266	3 895	3 086	0.9%	-9 180	-75%	-809	-21%
Ireland	4 845	2 196	1 231	0.4%	-3 614	-75%	-966	-44%
Italy	27 756	20 456	11 979	3.5%	-15 777	-57%	-8 477	-41%
Latvia	211	3	2	0.0%	-210	-99%	-1	-43%
Lithuania	174	5	3	0.0%	-171	-98%	-2	-33%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	710	NO	NO	-	-710	-100%	-	-
Netherlands	25 862	16 506	10 625	3.1%	-15 237	-59%	-5 881	-36%
Poland	220 132	136 843	109 096	31.7%	-111 035	-50%	-27 746	-20%
Portugal	7 921	NO	NO	-	-7 921	-100%	-	-
Romania	25 734	9 471	7 403	2.2%	-18 332	-71%	-2 069	-22%
Slovakia	11 542	1 592	1 552	0.5%	-9 990	-87%	-40	-3%
Slovenia	5 712	3 025	2 942	0.9%	-2 770	-48%	-83	-3%
Spain	58 156	9 454	5 247	1.5%	-52 910	-91%	-4 208	-45%
Sweden	4 231	1 610	1 633	0.5%	-2 598	-61%	23	1%
EU-27	**942 629**	**474 349**	**344 275**	**100%**	**-598 354**	**-63%**	**-130 074**	**-27%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 3.16 shows the trend of emissions for solid fuels for main contributing countries.

Figure 3.16 1.A.1.a Public Electricity and Heat Production, Solid Fuels: Emission trend and share for CO_2

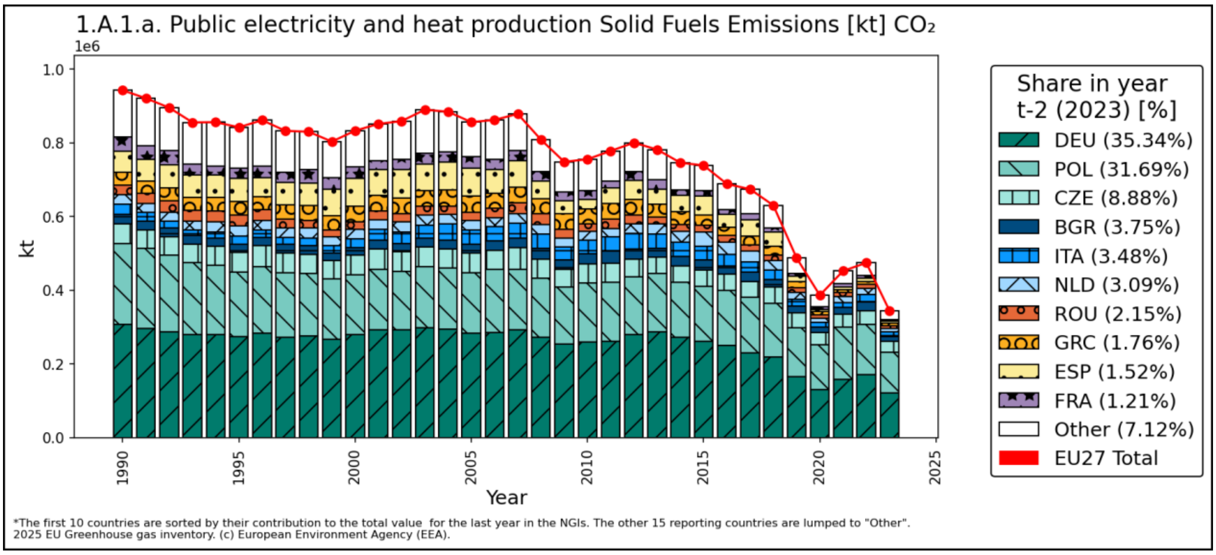
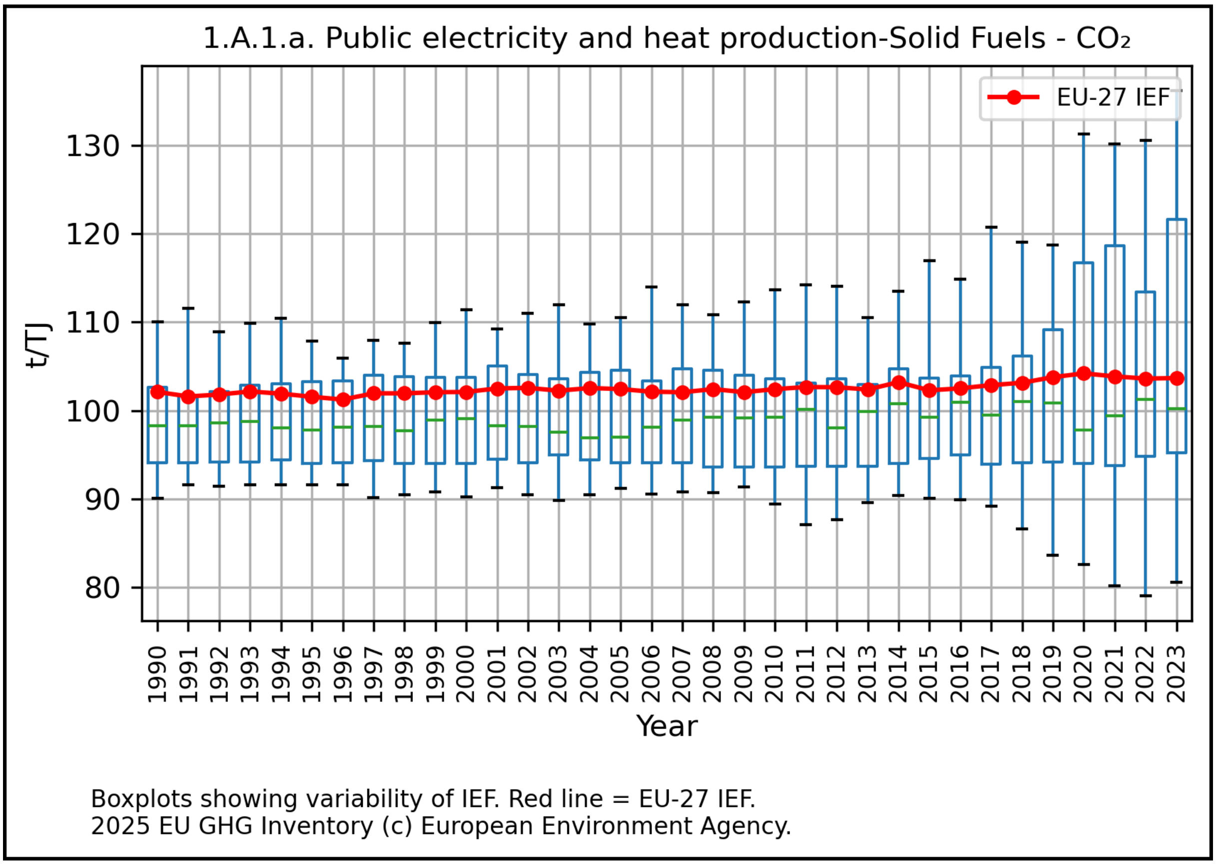


Figure 3.17 (on the next page) shows the relevant implied emission factors for solid fuels. The EU implied emission factor has remained fairly stable between 100 t/TJ and 103 t/TJ on the entire time-series (around 103.7 t/TJ in 2023).

Figure 3.17 1.A.1.a Public Electricity and Heat Production, Solid Fuels: Implied Emission Factors for CO_2



1.A.1.a Electricity and Heat Production - Gaseous Fuels (CO_2)

CO_2 emissions from the combustion of gaseous fuels accounted for 28.2% of all greenhouse gas emissions from public electricity and heat generation in 2023. Emissions increased by 51% in the EU between 1990 and 2023 (Table 3.12).

Table 3.12 1.A.1.a Electricity and heat production, Gaseous Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	3 294	4 330	3 206	2.0%	-88	-3%	-1 124	-26%
Belgium	2 706	6 197	4 692	2.9%	1 986	73%	-1 505	-24%
Bulgaria	6 295	1 835	1 735	1.1%	-4 560	-72%	-100	-5%
Croatia	991	1 730	1 925	1.2%	934	94%	195	11%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	1 019	2 781	2 518	1.5%	1 498	147%	-263	-9%
Denmark	1 000	494	548	0.3%	-452	-45%	54	11%
Estonia	1 812	281	231	0.1%	-1 581	-87%	-49	-18%
Finland	1 989	585	873	0.5%	-1 116	-56%	288	49%
France	970	14 807	11 283	6.9%	10 313	1063%	-3 524	-24%
Germany	18 447	29 978	29 605	18.2%	11 158	60%	-373	-1%
Greece	NO	7 339	6 172	3.8%	6 172	∞	-1 166	-16%
Hungary	4 111	4 826	4 100	2.5%	-11	0%	-726	-15%
Ireland	1 881	5 599	5 204	3.2%	3 323	177%	-395	-7%
Italy	16 173	48 832	40 297	24.8%	24 124	149%	-8 534	-17%
Latvia	2 658	840	845	0.5%	-1 812	-68%	5	1%
Lithuania	5 797	440	437	0.3%	-5 359	-92%	-3	-1%
Luxembourg	NO	119	88	0.1%	88	∞	-31	-26%
Malta	NO	747	782	0.5%	782	∞	35	5%
Netherlands	13 329	13 523	12 725	7.8%	-604	-5%	-797	-6%
Poland	1 197	5 588	7 645	4.7%	6 448	539%	2 057	37%
Portugal	NO	5 593	3 267	2.0%	3 267	∞	-2 326	-42%
Romania	20 845	5 207	4 849	3.0%	-15 996	-77%	-358	-7%
Slovakia	2 089	1 509	1 485	0.9%	-604	-29%	-24	-2%
Slovenia	113	277	317	0.2%	204	180%	40	14%
Spain	447	25 300	17 659	10.9%	17 213	3854%	-7 641	-30%
Sweden	486	C	C	-	-486	-100%	-	-
EU-27	**107 649**	**188 757**	**162 489**	**100%**	**54 840**	**51%**	**-26 268**	**-14%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period

Abbreviations are explained in the Chapter 'Units and abbreviations'. The information on methodologies and emission factors is not available from the JSON on fuels level Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.18 shows the trend of emissions from gaseous fuels by the main contributing countries. One of the reasons for the recent increase is that coal is in the process of being phased out of the fuel mix and replaced by gaseous fuels in many countries. However, consumptions are decreasing since 2019, particularly between 2022 and 2023 with a drop of 14% of consumptions due to international circumstances).

Figure 3.18 1.A.1.a Public Electricity and Heat Production, Gaseous Fuels: Emission trend and share for CO_2

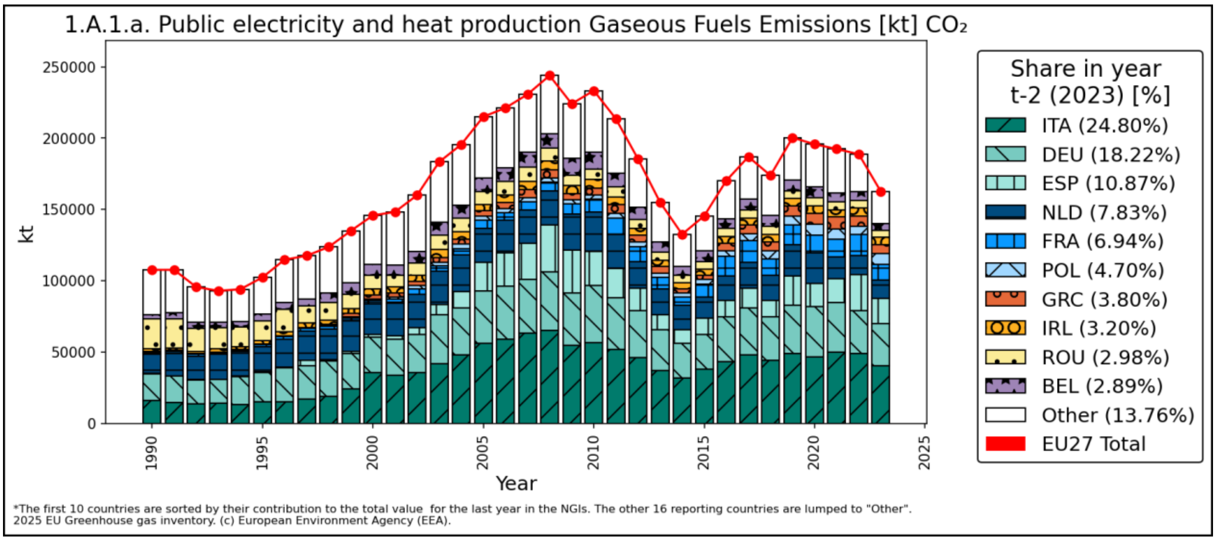
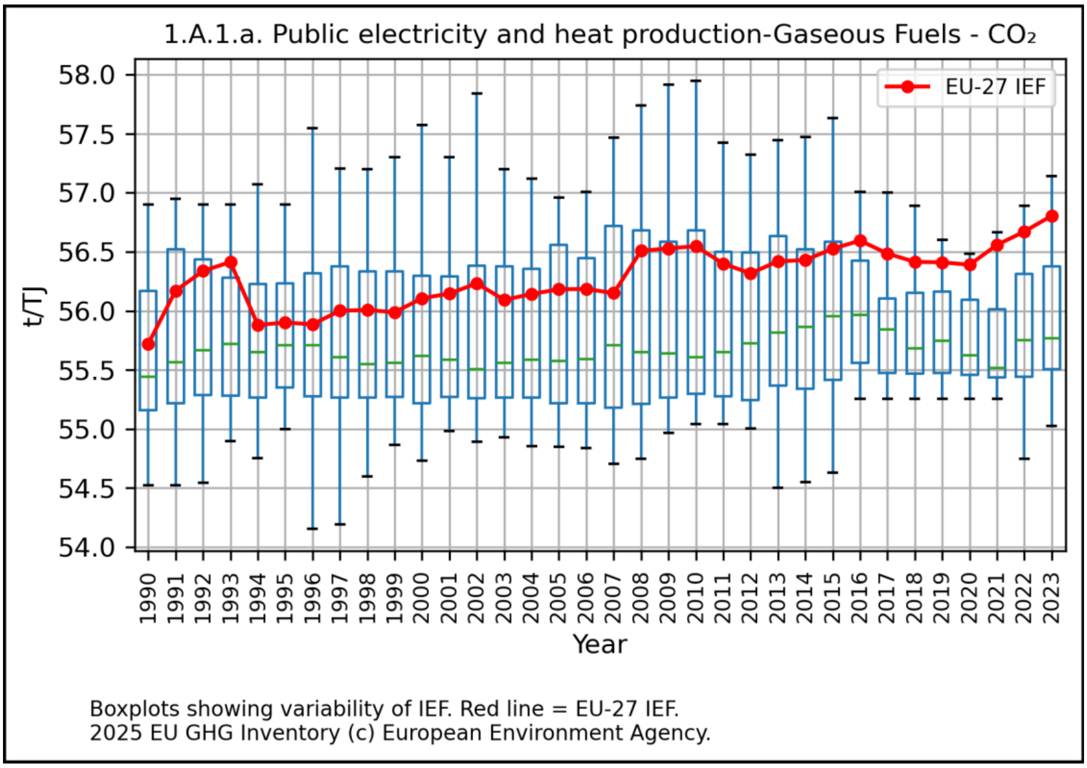


Figure 3.19 (on the next page) shows the implied emission factors from gaseous fuels for CO_2. The EU implied emission factor has slightly increased since 2020 from 56.4 to 56.8 which is close to the default emission factor of natural gas (56.1 t/TJ). The IEF is driven by the source of importation of natural gas and its composition.

Figure 3.19 1.A.1.a Public Electricity and Heat Production, Gaseous Fuels: Implied Emission Factors for CO_2



1.A.1.a Electricity and Heat Production - Other Fuels (CO_2)

In 2023, the share of CO_2 emissions from other fuels amounts to 6.3% of total greenhouse gas emissions from public electricity and heat generation. Other fuels cover mainly the fossil part of municipal solid waste incineration where there is energy recovery, including plastics, hazardous waste, bulky waste and waste sludge (Table 3.13).

Table 3.13 1.A.1.a Public Electricity and Heat Production, Other Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	286	1 028	1 094	3.0%	807	282%	66	6%
Belgium	674	2 007	2 076	5.7%	1 402	208%	68	3%
Bulgaria	NO	NO	NO	-	-	-	-	-
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	24	271	310	0.9%	286	1188%	39	14%
Denmark	539	1 647	1 656	4.6%	1 118	208%	9	1%
Estonia	NO	112	137	0.4%	137	∞	25	23%
Finland	1	614	624	1.7%	623	62193%	10	2%
France	2 557	7 064	7 068	19.6%	4 511	176%	5	0%
Germany	4 121	13 126	13 126	36.3%	9 005	219%	0	0%
Greece	NO	NO	NO	-	-	-	-	-
Hungary	30	205	186	0.5%	156	522%	-18	-9%
Ireland	NO	519	540	1.5%	540	∞	21	4%
Italy	143	117	106	0.3%	-37	-26%	-11	-9%
Latvia	3	NO	NO	-	-3	-100%	-	-
Lithuania	NO	406	234	0.6%	234	∞	-171	-42%
Luxembourg	32	100	99	0.3%	67	206%	0	0%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	601	2 667	2 548	7.1%	1 946	324%	-119	-4%
Poland	753	1 026	958	2.7%	205	27%	-68	-7%
Portugal	NO	433	388	1.1%	388	∞	-44	-10%
Romania	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Slovakia	36	175	158	0.4%	122	342%	-18	-10%
Slovenia	NO	20	20	0.1%	20	∞	1	3%
Spain	128	1 768	1 800	5.0%	1 672	1311%	32	2%
Sweden	524	3 069	2 994	8.3%	2 470	471%	-75	-2%
EU-27	**10 453**	**36 372**	**36 123**	**100%**	**25 670**	**246%**	**-249**	**-1%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 3.20 illustrates clearly the strong increase of emissions caused by other fuels over the past 33 years.

Figure 3.20 1.A.1.a Public Electricity and Heat Production, Other Fuels: Emission trend and share for CO_2

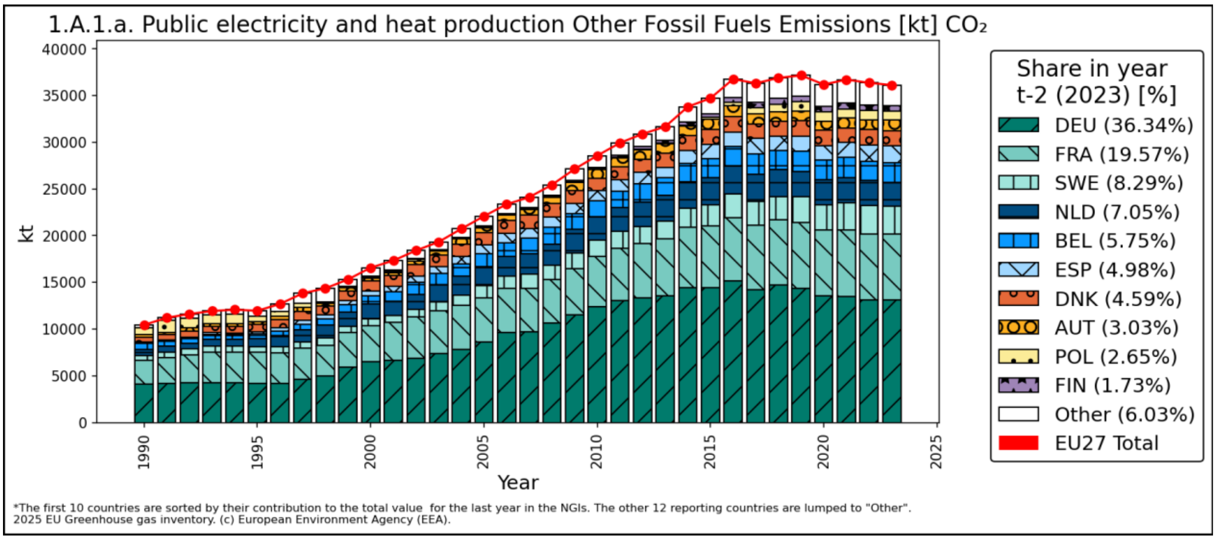
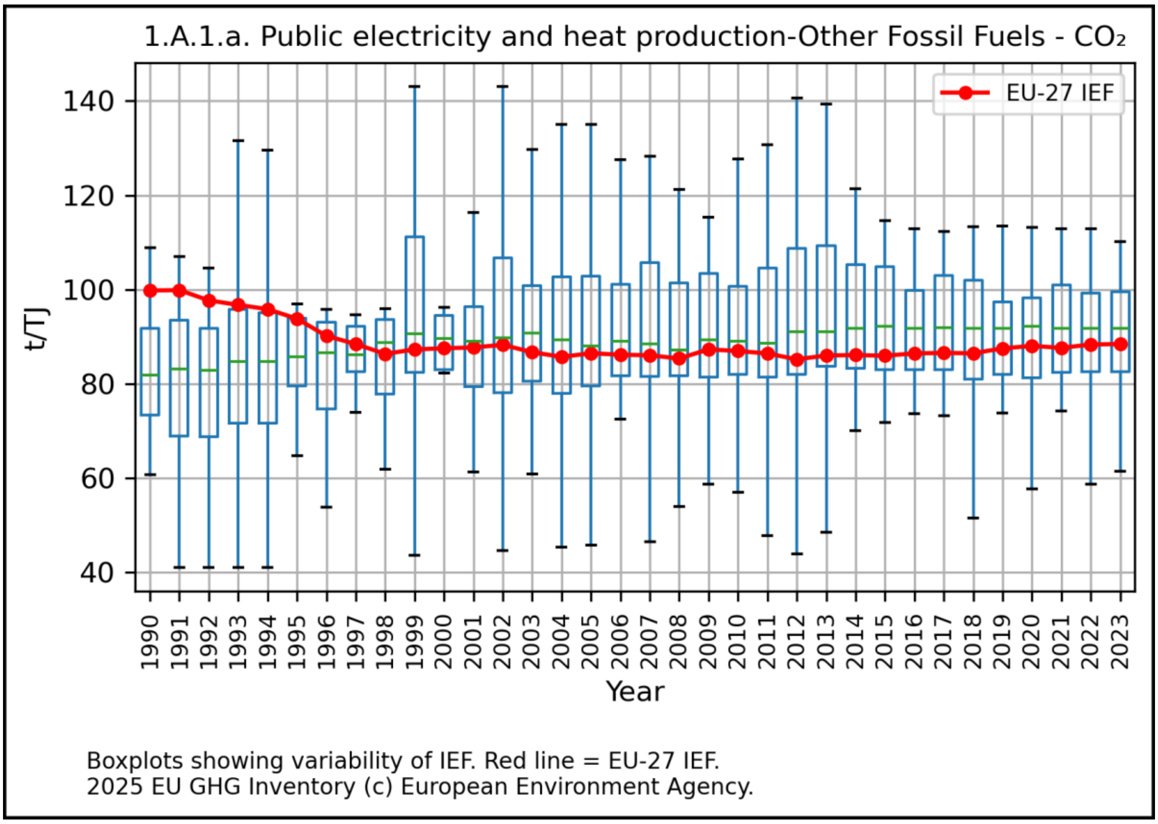


Figure 3.21 (on the next page) shows the implied emission factors from other fuels for CO_2. The EU implied emission factor has gradually fallen until 1998, then levelled out between 86 and 90 t/TJ on the entire time-series. This is because the combustion of industrial waste has been greatly reduced in the early 1990s whereas the combustion of residential waste for electricity and heat has increased in the complete reporting period; furthermore, the calorific value of the applied waste has increased due to a better national waste separation management. There is a large diversity in waste composition across countries leading to the differences in countries' IEFs.

Figure 3.21 1.A.1.a Public Electricity and Heat Production, Other Fuels: Implied Emission Factors for CO_2



1.A.1.a Electricity and Heat Production - Peat (CO_2)

CO_2 emissions from the combustion of peat represented 0.4% of all greenhouse gas emissions from public electricity and heat production. Peat in its raw state is a fossil sedimentary deposit of vegetal origin with high water content. Within the EU, emissions declined by 72% respectively 6.6 Mt CO_2 between 1990 and 2023 and by 31% between 2022 and 2023 (Table 3.14).

Table 3.14 1.A.1.a Public Electricity and Heat Production, Peat: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	NO	NO	NO	-	-	-	-	-
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	NO	NO	NO	-	-	-	-	-
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Estonia	843	26	16	0.6%	-827	-98%	-10	-39%
Finland	3 950	3 310	2 245	87.7%	-1 704	-43%	-1 064	-32%
France	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Germany	NO	NO	NO	-	-	-	-	-
Greece	NO	NO	NO	-	-	-	-	-
Hungary	NO	NO	NO	-	-	-	-	-
Ireland	3 065	277	193	7.5%	-2 872	-94%	-84	-30%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	146	1	0	0.0%	-146	-100%	-1	-83%
Lithuania	11	13	8	0.3%	-3	-28%	-5	-37%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	NO	NO	NO	-	-	-	-	-
Poland	NO	NO	NO	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-
Romania	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	NO	NO	NO	-	-	-	-	-
Sweden	1 150	107	98	3.8%	-1 052	-91%	-9	-9%
EU-27	**9 164**	**3 733**	**2 560**	**100%**	**-6 604**	**-72%**	**-1 173**	**-31%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 3.22 illustrates the trend of peat emissions throughout the last 33 years.

Figure 3.22 1.A.1.a Public Electricity and Heat Production, Peat: Emission trend and share for CO_2

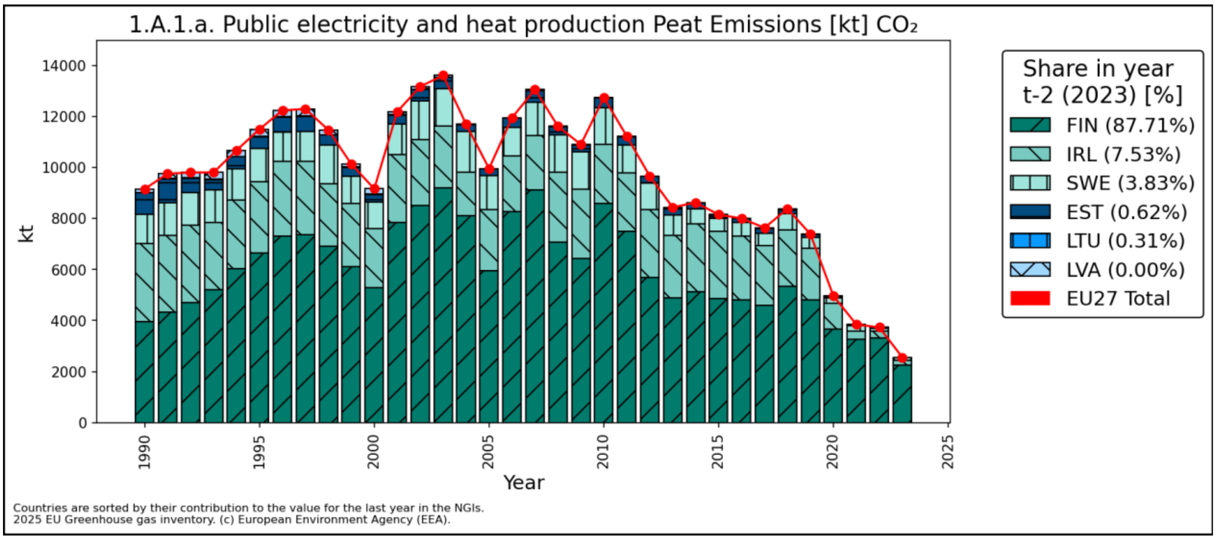
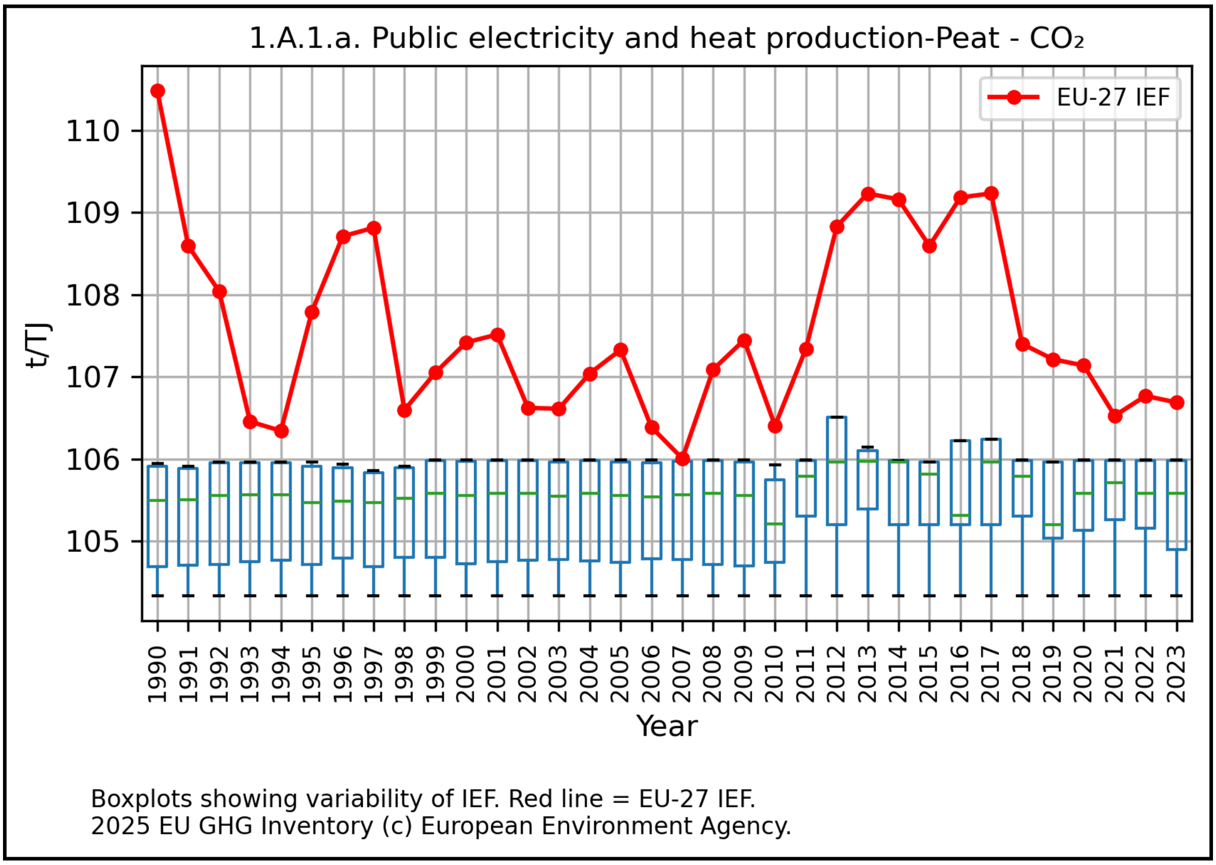


Figure 3.23 shows the implied emission factors of peat for CO_2. The EU implied emission factor amounts to 106.7 t/TJ in 2023 and has been quite stable over the last 33 years. It is mainly influenced by the IEF of the two largest emitters. The default emission factor for peat is 106 t/TJ according to the 2006 IPCC guidelines.

Figure 3.23 1.A.1.a Public Electricity and Heat Production, Peat: Implied Emission Factors for CO_2



3.6.1.2 Petroleum Refining (1.A.1.b) (EU)

According to the 2006 IPCC guidelines, Petroleum Refining (CRT 1.A.1.b) should include all combustion activities supporting the refining of petroleum products including on-site combustion for the generation of electricity and heat for own use. It does not include evaporative emissions occurring at the refinery. These emissions should be reported separately under 1.B.2.a as well as venting and flaring under 1.B.2.c.

Total emissions from Petroleum Refining are accounting for 3.2% of total greenhouse gas emissions in year 2023. Between 1990 and 2023, EU CO_2 emissions decreased by 13% (Table 3.15). The decrease at European level can be explained by the reduction of Liquid fuels consumptions.

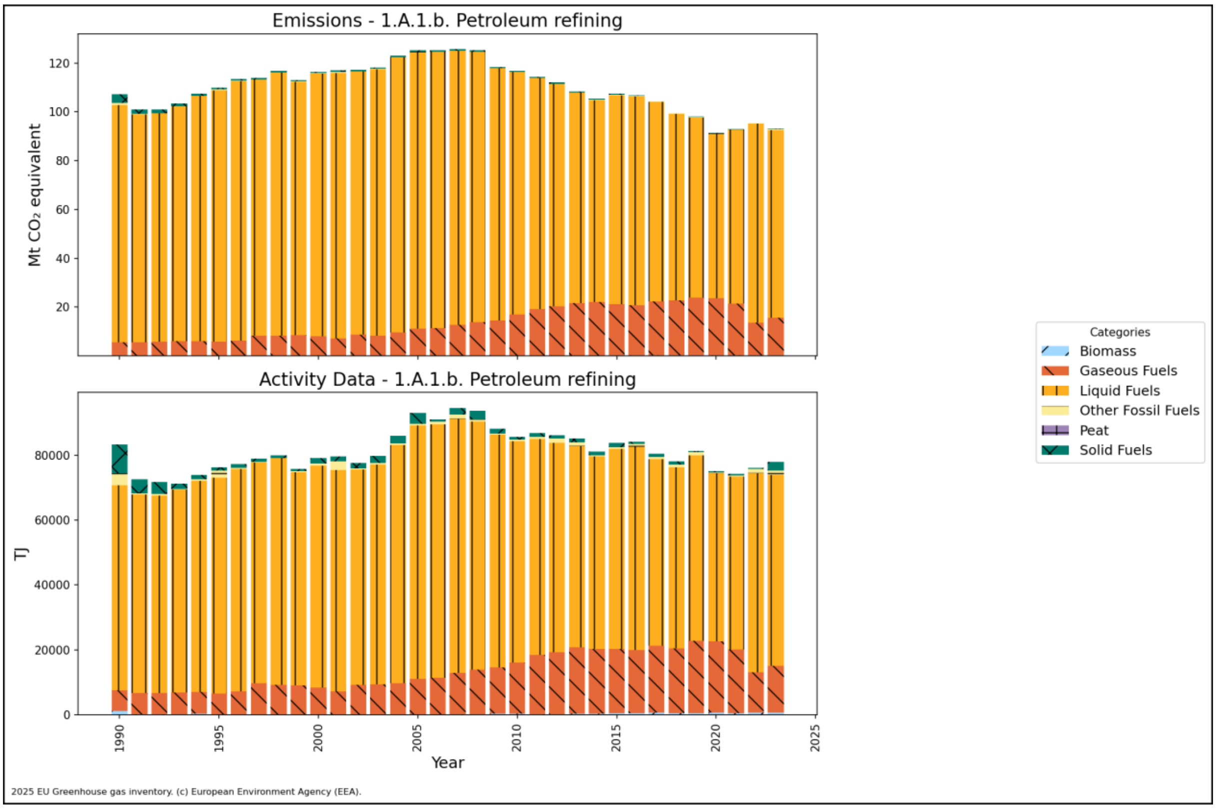
Table 3.15 1.A.1.b Petroleum Refining: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	2 394	2 255	2 580	2.8%	185	8%	325	14%	NA,T2	CS,NA
Belgium	4 299	4 727	4 525	4.9%	226	5%	-202	-4%	CS,NA,T3	NA,PS
Bulgaria	860	1 031	955	1.0%	95	11%	-77	-7%	NA,T1,T2	CS,D,NA
Croatia	2 425	695	717	0.8%	-1 707	-70%	22	3%	NA,T1	D,NA
Cyprus	86	NO	NO	-	-86	-100%	-	-	NA	NA
Czechia	493	506	528	0.6%	35	7%	22	4%	NA,T1,T2	CS,D,NA
Denmark	908	912	899	1.0%	-9	-1%	-13	-1%	NA,T2,T3	CS,NA,PS
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	2 042	1 415	1 495	1.6%	-547	-27%	80	6%	NA,T3	CS,NA,PS
France	11 935	5 189	5 618	6.0%	-6 318	-53%	429	8%	T2,T3	CS,D,OTH,PS
Germany	24 212	22 274	20 373	21.9%	-3 839	-16%	-1 901	-9%	CS,NA	CS,NA
Greece	2 375	5 841	5 535	6.0%	3 160	133%	-307	-5%	NA,T2	NA,PS
Hungary	2 376	1 493	1 562	1.7%	-814	-34%	69	5%	NA,T2,T3	CS,NA,PS
Ireland	168	308	287	0.3%	118	70%	-21	-7%	NA,T3	CS,NA,PS
Italy	15 817	19 035	18 247	19.6%	2 430	15%	-788	-4%	NA,T3	CS,NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	1 510	1 241	1 373	1.5%	-137	-9%	132	11%	NA,T2,T3	CS,NA,PS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	11 010	9 431	9 292	10.0%	-1 719	-16%	-140	-1%	NA,T2	CS,D,NA
Poland	2 169	3 935	4 469	4.8%	2 300	106%	533	14%	NA,T1,T2	CS,D,NA
Portugal	1 870	1 523	1 372	1.5%	-498	-27%	-151	-10%	NO,T2	CR,D,NO,PS
Romania	4 282	1 935	1 659	1.8%	-2 623	-61%	-277	-14%	NA,T3	NA,PS
Slovakia	2 990	1 893	1 883	2.0%	-1 108	-37%	-10	-1%	NA,T3	NA,PS
Slovenia	171	NO	NO	-	-171	-100%	-	-	NA	NA
Spain	10 858	9 606	9 534	10.3%	-1 324	-12%	-72	-1%	NA,T2,T3	NA,PS
Sweden	1 778	C,NO	C,NO	-	-1 778	-100%	-	-	T2	CS
EU-27	**107 030**	**95 249**	**92 901**	**100%**	**-14 128**	**-13%**	**-2 347**	**-2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.24 shows the trends in activity data and the associated emissions originating from the refining of petroleum by fuel in the EU between the years 1990 and 2023. Fuel used for petroleum refining decreased by 8.2% in the EU between 1990 and 2023. In the year 2023, liquid fuels represent about 80% of all fuel used in the refining of petroleum. Gaseous fuels almost fully account for the remaining part (around 19%) of the activity data. Gaseous fuels use is three times higher in 2023 compared to 1990. There remains a small amount of biomass and solid fuels used respectively accounting for 0.22% and 0.36% in petroleum refining.

Figure 3.24   1.A.1.b Petroleum Refining: Total emission and activity trends



1.A.1.b Petroleum Refining - Liquid Fuels (CO_2)

CO_2 emissions from the combustion of liquid fuels used for petroleum refining accounted for 82.9% of all greenhouse gas CO_2 emissions from petroleum refining in 2023. Emissions decreased by 21% between 1990 and 2023 (Table 3.16).

Table 3.16 1.A.1.b Petroleum Refining, Liquid Fuels: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 958	1 955	2 252	2.9%	295	15%	298	15%	T2	CS
Belgium	4 285	3 677	3 150	4.1%	-1 135	-26%	-527	-14%	CS,T3	PS
Bulgaria	791	991	914	1.2%	123	16%	-77	-8%	T1	D
Croatia	2 411	464	387	0.5%	-2 024	-84%	-77	-17%	T1	D
Cyprus	86	NO	NO	-	-86	-100%	-	-	NA	NA
Czechia	176	291	312	0.4%	136	77%	20	7%	T1	CS,D
Denmark	908	901	865	1.1%	-43	-5%	-37	-4%	T2,T3	PS
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 383	1 369	1 444	1.9%	62	4%	76	6%	T3	CS,PS
France	11 413	3 919	4 230	5.5%	-7 184	-63%	311	8%	T2,T3	CS,D,OTH,PS
Germany	19 464	20 822	18 396	23.9%	-1 068	-5%	-2 426	-12%	CS	CS
Greece	2 375	5 841	5 535	7.2%	3 160	133%	-307	-5%	T2	PS
Hungary	1 683	914	953	1.2%	-730	-43%	40	4%	T3	PS
Ireland	168	295	275	0.4%	106	63%	-20	-7%	T3	CS,PS
Italy	15 656	16 317	15 517	20.2%	-140	-1%	-800	-5%	T3	CS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	1 510	1 221	1 361	1.8%	-149	-10%	140	11%	T2,T3	CS,PS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	9 968	8 276	7 916	10.3%	-2 052	-21%	-360	-4%	T2	CS,D
Poland	1 326	2 698	2 664	3.5%	1 338	101%	-35	-1%	T1,T2	CS,D
Portugal	1 870	991	836	1.1%	-1 034	-55%	-155	-16%	T2	CR,D,PS
Romania	4 282	1 791	1 488	1.9%	-2 794	-65%	-303	-17%	T3	PS
Slovakia	2 786	1 418	1 378	1.8%	-1 408	-51%	-40	-3%	T3	PS
Slovenia	43	NO	NO	-	-43	-100%	-	-	NA	NA
Spain	10 812	7 424	7 130	9.3%	-3 682	-34%	-295	-4%	T2,T3	PS
Sweden	1 778	C	C	-	-1 778	-100%	-	-	T2	CS
EU-27	**97 131**	**81 575**	**77 001**	**100%**	**-20 130**	**-21%**	**-4 573**	**-6%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.25 illustrates that the trend for liquid fuels was continuously decreasing since the year 2008 with a stabilization between 2014 and 2016. An increase can be observed between 2020 and 2022 following the COVID crisis followed by a slight decrease in 2023.

Figure 3.25 1.A.1.b Petroleum Refining, Liquid Fuels: Emission trend and share for CO_2

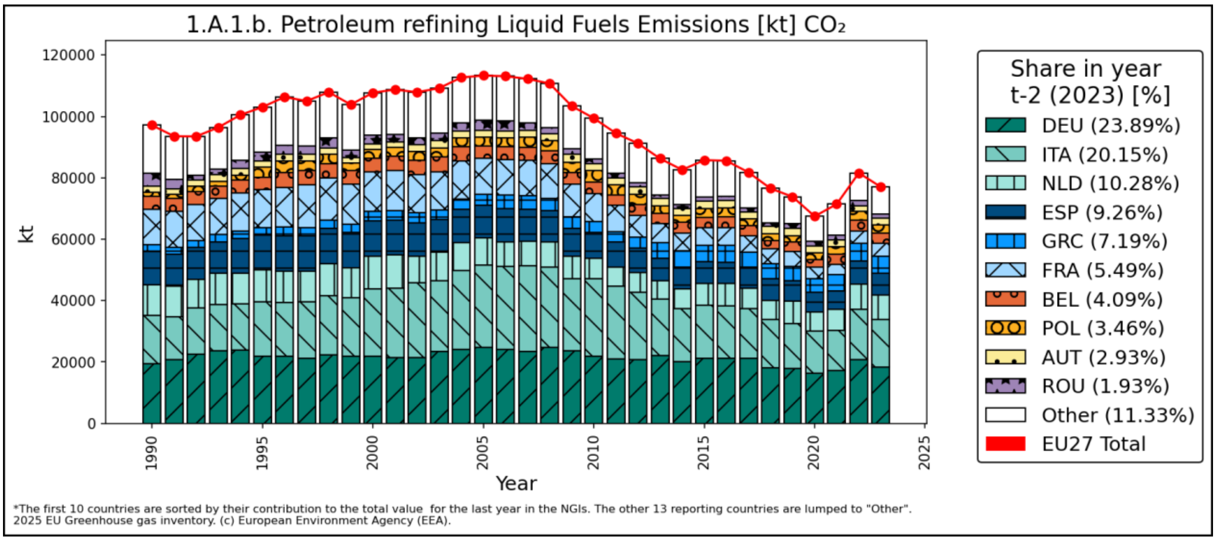
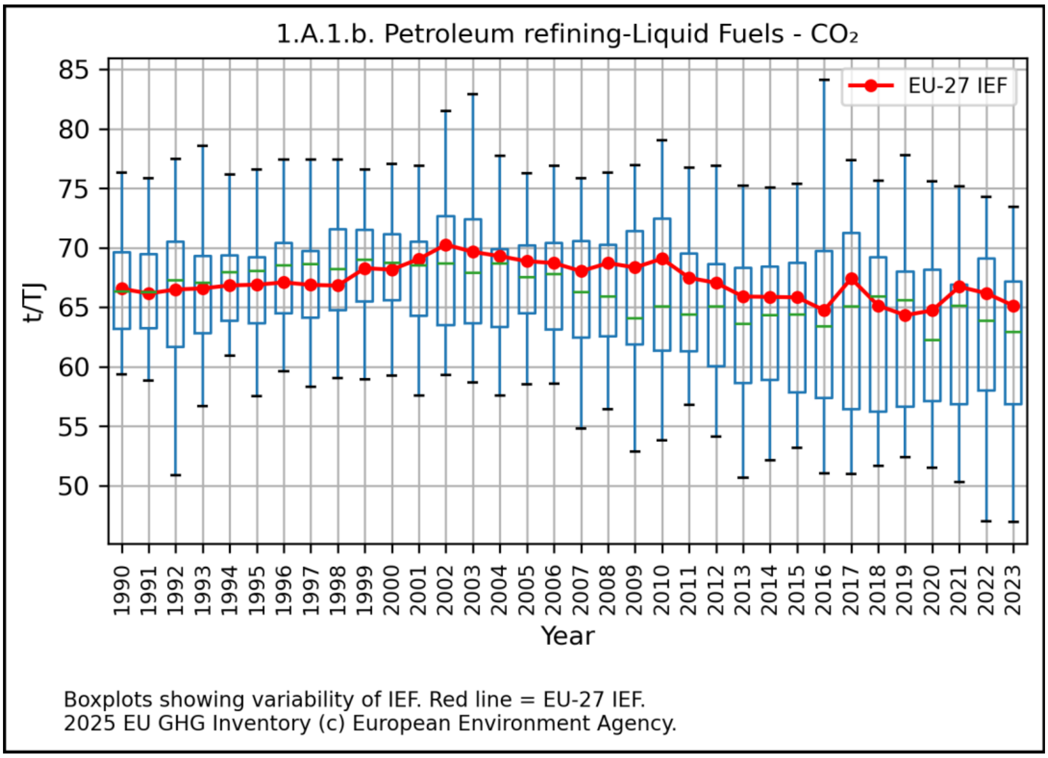


Figure 3.26 (on the next page) shows the emission factors for CO_2 emissions from liquid fuels. The EU implied emission factor shows variations around 68 t/TJ over the time series and amounts 65.4 t/TJ in 2023. In general, the fluctuating IEF is due to the annual variations of fuel consumption with different carbon content. The IEF declining trend observed since 2002 is due to the higher share of refinery gas in the energy mix.

Figure 3.26 1.A.1.b Petroleum Refining, Liquid Fuels: Implied Emission Factors for CO_2



1.A.1.b Petroleum Refining - Solid Fuels (CO_2)

CO_2 emissions from the combustion of solid fuels in petroleum refining represented less than 0.2 of all CO_2 emissions from 1.A.1.b in 2023. Over the whole times series emissions fell by 93% on average (Table 3.17).

Table 3.17 1.A.1.b Petroleum Refining, Solid Fuels: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	NO	NO	NO	-	-	-	-	-	NA	NA
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	NO	NO	NO	-	-	-	-	-	NA	NA
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	NO	NO	NO	-	-	-	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	12	NO	NO	-	-12	-100%	-	-	NA	NA
France	486	NO	NO	-	-486	-100%	-	-	T2,T3	CS,D,OTH,PS
Germany	3 131	NO	188	77.0%	-2 942	-94%	188	∞	CS	CS
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	NO	NO	NO	-	-	-	-	-	NA	NA
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	NO	NO	NO	-	-	-	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	4	55	56	23.0%	52	1222%	1	1%	T1,T2	CS,D
Portugal	NO	NO	NO	-	-	-	-	-	NO	NO
Romania	NO	5	NO	-	-	-	-5	-100%	NA	NA
Slovakia	NO	NO	NO	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	NO	NO	NO	-	-	-	-	-	NA	NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**3 633**	**60**	**245**	**100%**	**-3 388**	**-93%**	**184**	**306%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 3.27 illustrates the trend of emissions in 1.A.1.b for solid fuels for the past 33 years. The use of solid fuels in petroleum refining has declined drastically since 1990.

Figure 3.27 1.A.1.b Petroleum Refining, Solid Fuels: Emission trend and share for CO_2

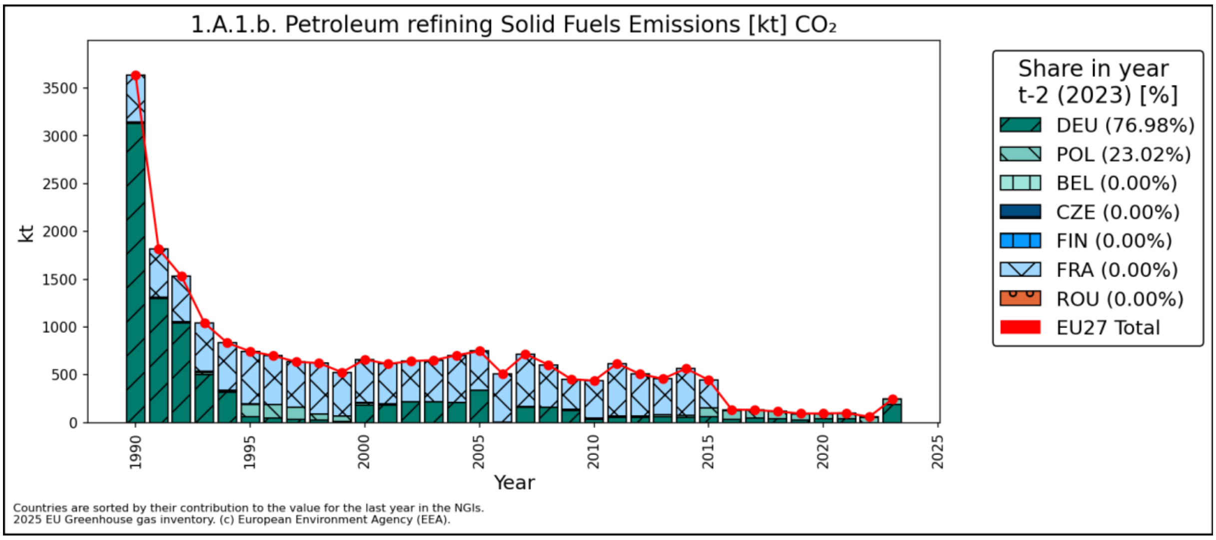
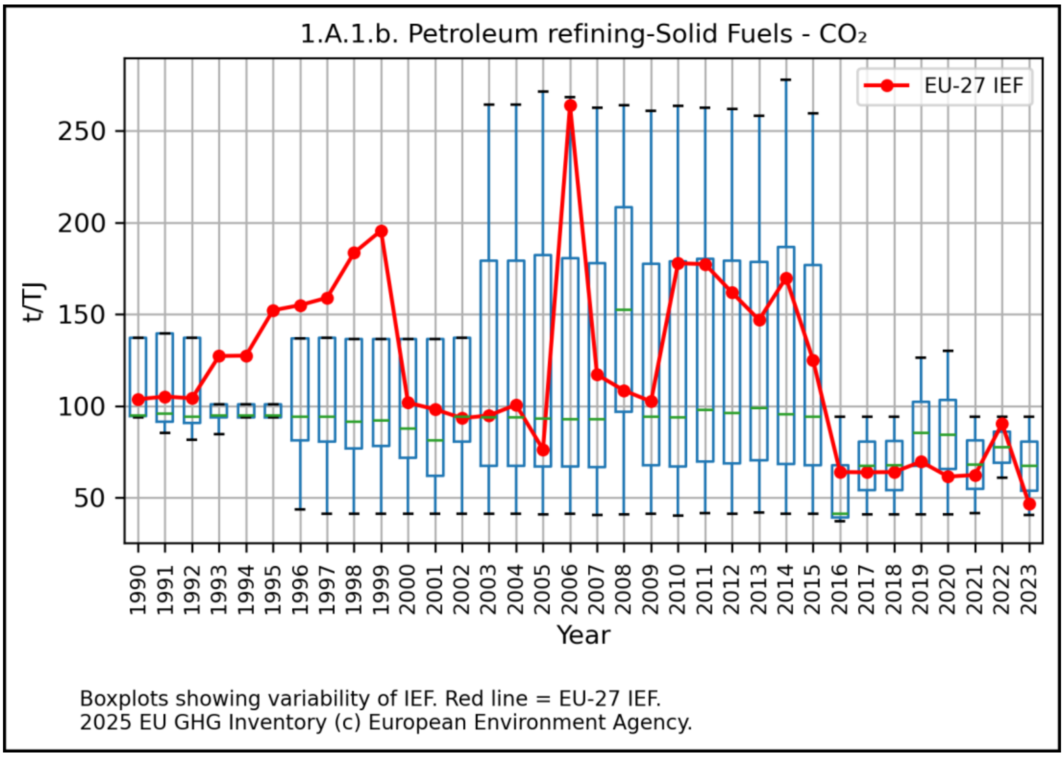


Figure 3.28 (on the next page) shows the relevant implied emission factors. The EU implied emission factor showed strong fluctuations and amounts 46.6 t/TJ in 2023. One explanation for this is the low number of countries reporting this category. Apart from that, the variation in the EU factor can be partly explained by the declining use of solid fuels in petroleum refining. The evolution of the IEF on the time-series can be explained by the fuel mix (including the use of blast furnace gas; lignite, etc. for example).

Figure 3.28 1.A.1.b Petroleum Refining, Solid Fuels: Implied Emission Factors for CO_2



1.A.1.b Petroleum Refining - Gaseous Fuels (CO_2)

In 2023, CO_2 emissions from the combustion of gaseous fuels used for petroleum refining accounted for about 16.6% of total CO_2 emissions from 1.A.1.b. Emissions in the EU increased by 188% between 1990 and 2023 (Table 3.18).

Table 3.18 1.A.1.b Petroleum Refining, Gaseous Fuels: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	437	300	327	2.1%	-110	-25%	27	9%	T2	CS
Belgium	14	1 040	1 371	8.9%	1 357	9769%	331	32%	CS,T3	PS
Bulgaria	69	40	41	0.3%	-28	-40%	1	1%	T2	CS
Croatia	14	231	330	2.1%	316	2268%	99	43%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	317	215	216	1.4%	-101	-32%	1	1%	T2	CS
Denmark	NO	10	34	0.2%	34	∞	24	227%	T2	CS
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	648	46	51	0.3%	-597	-92%	5	10%	T3	CS
France	36	1 112	1 176	7.6%	1 140	3149%	64	6%	T2,T3	CS,D,OTH,PS
Germany	1 444	1 452	1 789	11.6%	345	24%	337	23%	CS	CS
Greece	NO	IE	IE	-	-	-	-	-	NA	NA
Hungary	693	567	602	3.9%	-91	-13%	35	6%	T3	PS
Ireland	NO	13	12	0.1%	12	∞	-1	-9%	T3	CS,PS
Italy	161	2 719	2 731	17.7%	2 570	1599%	12	0%	T3	CS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	20	12	0.1%	12	∞	-8	-41%	T2	CS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	1 042	1 155	1 375	8.9%	333	32%	220	19%	T2	CS
Poland	92	1 182	1 749	11.3%	1 656	1791%	567	48%	T2	CS
Portugal	NO	532	536	3.5%	536	∞	4	1%	T2	CR,D,PS
Romania	NO	140	171	1.1%	171	∞	31	22%	T3	PS
Slovakia	205	475	505	3.3%	301	147%	30	6%	T3	PS
Slovenia	128	NO	NO	-	-128	-100%	-	-	NA	NA
Spain	46	2 159	2 383	15.5%	2 337	5083%	224	10%	T2,T3	PS
Sweden	NO	C	C	-	-	-	-	-	T2	CS
EU-27	**5 345**	**13 410**	**15 411**	**100%**	**10 066**	**188%**	**2 001**	**15%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.29 illustrates the trend of increasing emissions from gaseous fuels in category 1.A.1.b in the last 33 years. A big drop is observed since 2020 with a slight increase in 2023.

Figure 3.29 1.A.1.b Petroleum Refining, Gaseous Fuels: Emission trend and share for CO_2

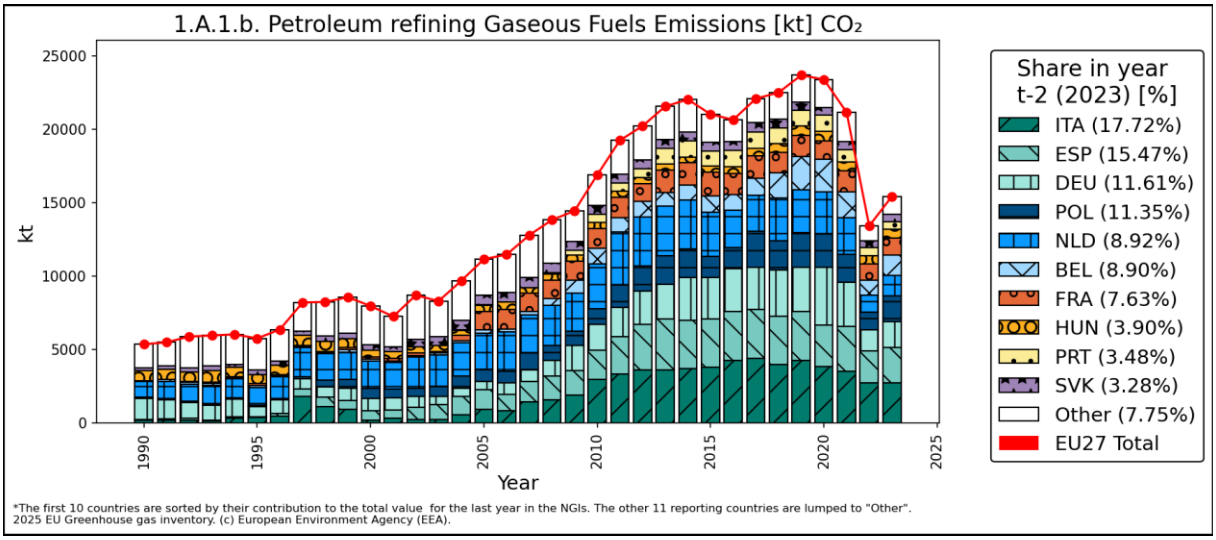
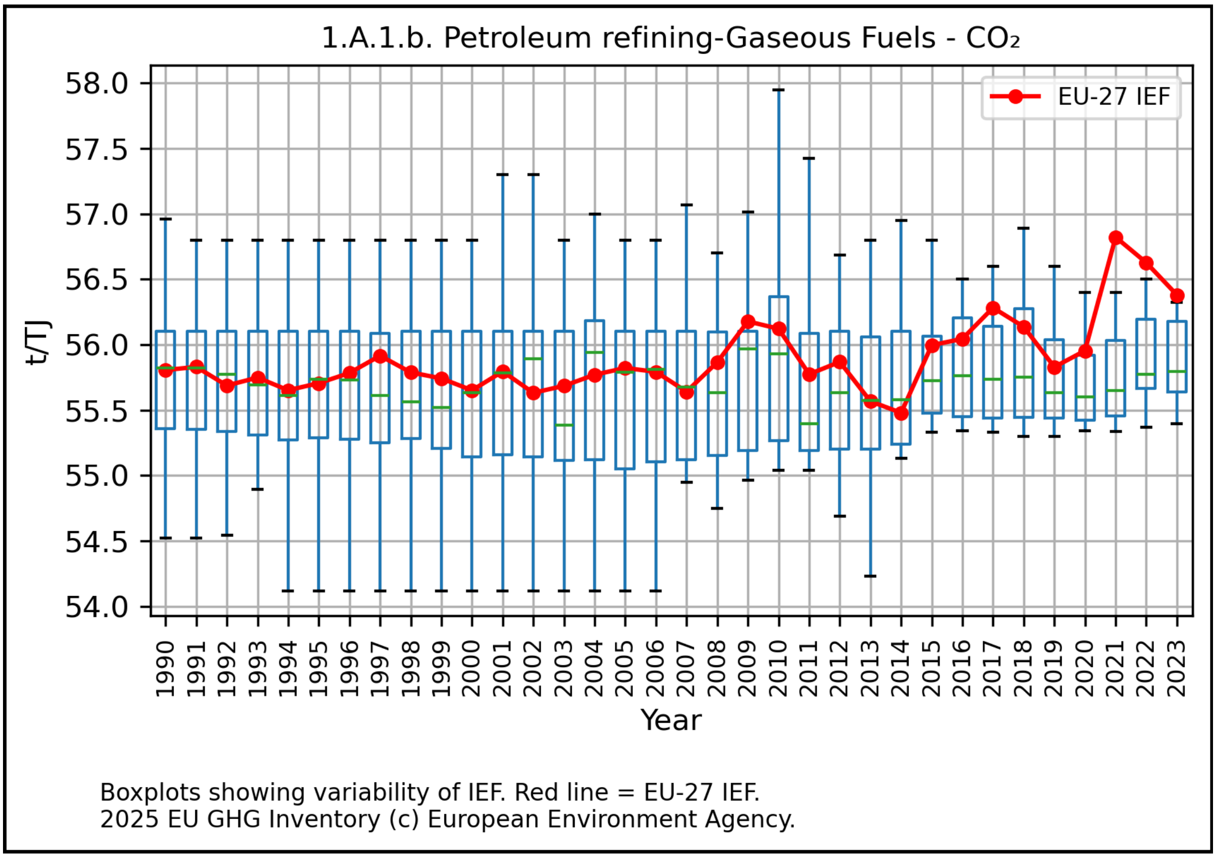


Figure 3.30 (on the next page) shows the implied emission factors for CO_2 emissions from gaseous fuels. The EU implied emission factor has remained broadly stable around 56.0 t/TJ on average on the entire time-series with a high value of 56.4 t/TJ in 2023 which remains in the IPCC range.

Figure 3.30 1.A.1.b Petroleum Refining, Gaseous Fuels: Implied Emission Factors for CO_2



Manufacture of Solid Fuels and Other Energy Industries (1.A.1.c) (EU)

According to the 2006 IPCC guidelines, the manufacture of solid fuels and other energy industries includes combustion emissions from fuel use during the manufacture of secondary and tertiary products from solid fuels including production of charcoal. It comprises combustion emissions from the production of coke, brown coal briquettes and patent fuel. It can also cover the emissions from own-energy use in coal mining and gas extraction. Emissions from own on-site fuel use should be included. In addition, this category includes emissions from fuel combustion in oil and natural gas production.

Total emissions from this category accounted for 1.0% of total EU greenhouse gas emissions in 2023. Between 1990 and 2023, CO_2 emissions fell by 73% in the EU (Table 3.19).

Table 3.19 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries: Countries' contributions to CO_2 emissions

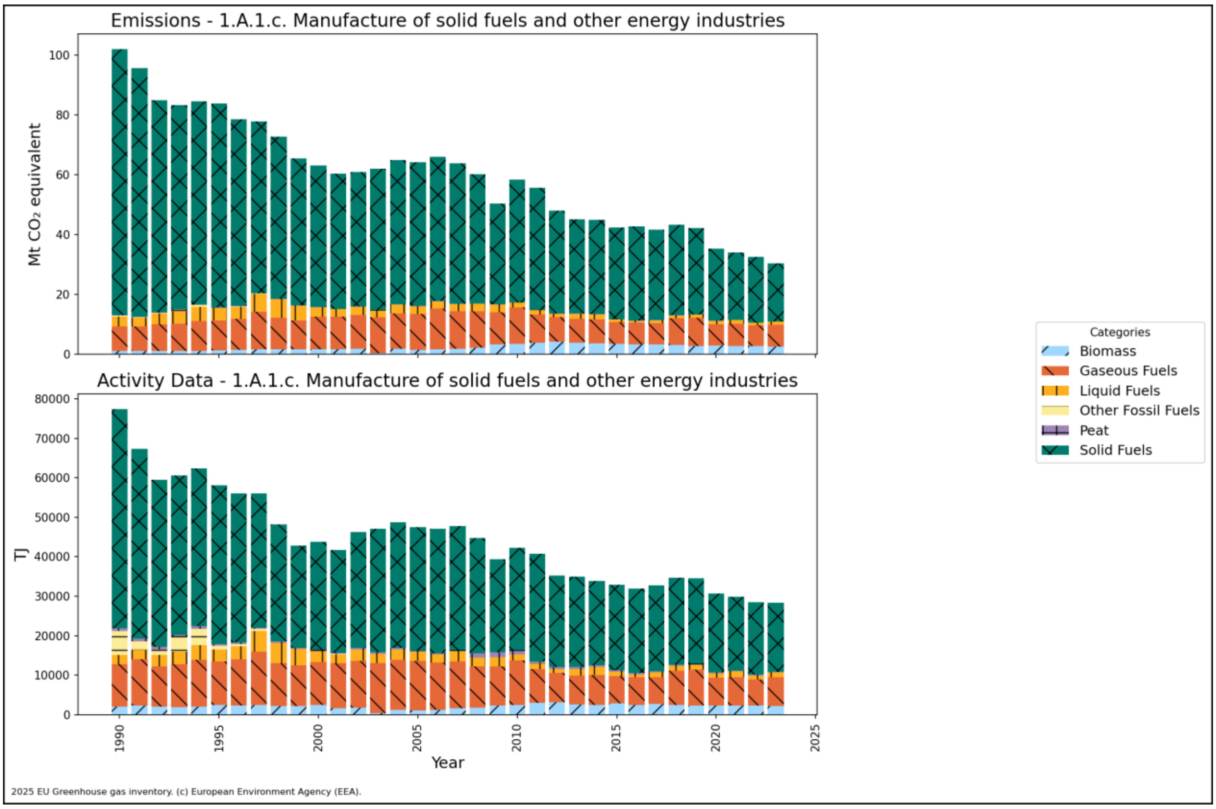
Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	510	210	155	0.6%	-355	-70%	-55	-26%	NA,T2	CS,NA
Belgium	2 024	161	157	0.6%	-1 867	-92%	-4	-2%	NA,T3	NA,PS
Bulgaria	362	5	5	0.0%	-358	-99%	0	-2%	NA,T1,T2	CS,D,NA
Croatia	912	307	314	1.1%	-598	-66%	8	3%	NA,T1	D,NA
Cyprus	NO	6	NO	-	-	-	-6	-100%	NA	NA
Czechia	1 516	1 600	1 413	5.1%	-103	-7%	-187	-12%	NA,T1,T2	CS,D,NA
Denmark	530	879	832	3.0%	302	57%	-47	-5%	NA,T2,T3	CS,NA
Estonia	78	1 561	1 760	6.4%	1 682	2145%	199	13%	T3	PS
Finland	347	318	320	1.2%	-27	-8%	3	1%	NA,T3	CS,NA
France	4 738	2 193	2 035	7.4%	-2 704	-57%	-158	-7%	T2,T3	CS,OTH,PS
Germany	65 289	9 150	7 903	28.6%	-57 386	-88%	-1 247	-14%	CS	CS
Greece	102	4	36	0.1%	-66	-65%	32	755%	NA,T2	NA,PS
Hungary	570	203	230	0.8%	-340	-60%	27	13%	NA,T1,T2,T3	CS,D,NA,PS
Ireland	100	67	34	0.1%	-67	-67%	-33	-50%	T3	CS
Italy	12 454	3 987	3 309	12.0%	-9 145	-73%	-678	-17%	T3	CS
Latvia	205	49	64	0.2%	-141	-69%	15	30%	NA,T2	CS,NA
Lithuania	9	52	39	0.1%	30	319%	-13	-25%	NA,T2	CS,NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	2 110	2 378	1 609	5.8%	-501	-24%	-769	-32%	NA,T2	CS,NA
Poland	4 849	3 324	3 464	12.5%	-1 385	-29%	140	4%	NA,T1,T2	CS,D,NA
Portugal	141	NO	NO	-	-141	-100%	-	-	NA,NO	NA,NO
Romania	146	1 006	1 232	4.5%	1 085	743%	225	22%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	1 319	1 186	1 267	4.6%	-52	-4%	81	7%	NA,T2	CS,NA
Slovenia	82	0	NO	-	-82	-100%	0	-100%	NA	NA
Spain	2 089	742	1 104	4.0%	-985	-47%	362	49%	NA,T1,T2	CS,D,NA,PS
Sweden	300	372	373	1.3%	72	24%	0	0%	T2	CS
EU-27	**100 786**	**29 759**	**27 653**	**100%**	**-73 133**	**-73%**	**-2 106**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 3.31 shows the trends in emissions from this source category by fuel in the EU between 1990 and 2023. The largest share of greenhouse gas emissions from the manufacture of solid fuels can be accounted to CO_2 emissions from solid (about 64% of emission), gaseous fuels (24%) and liquid fuels (the remaining share). Emissions from solid fuels fell markedly during the 1990s and then stabilized for a few years. Since 2006 they began to decrease again. The strong drop in 2009 was due to the drop-in coke production associated with the iron and steel production triggered by the economic downturn.

Fuel used for manufacturing solid fuels fell by 62.7% in the EU between 1990 and 2023. The strongest decline was reported for solid fuels (-72.4%), followed by liquid fuels (-63.0%). Only biomass consumptions increased in the period from 1990 to 2023.

Figure 3.31 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries: Total emission and activity trends



1.A.1.c Manufacture of Solid Fuels and Other Energy Industries – Solid Fuels (CO_2)

CO_2 emissions from the combustion of solid fuels used for the manufacture of solid fuels accounted for 69.7% of total greenhouse gas emissions from 1.A.1.c in 2023. Emissions in the EU declined by 75% since 1990.

Table 3.20 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Solid Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Belgium	2 017	161	157	0.8%	-1 860	-92%	-4	-2%
Bulgaria	274	0	0	0.0%	-274	-100%	0	-11%
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	1 352	1 584	1 401	7.3%	50	4%	-183	-12%
Denmark	NO	NO	NO	-	-	-	-	-
Estonia	78	1 561	1 760	9.1%	1 682	2145%	199	13%
Finland	347	318	320	1.7%	-27	-8%	3	1%
France	4 054	2 193	2 035	10.6%	-2 019	-50%	-158	-7%
Germany	61 101	7 834	6 767	35.1%	-54 334	-89%	-1 068	-14%
Greece	NO	NO	NO	-	-	-	-	-
Hungary	220	66	82	0.4%	-138	-63%	17	25%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	10 891	2 972	2 054	10.7%	-8 837	-81%	-918	-31%
Latvia	NO	NO	NO	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	916	1 290	664	3.4%	-252	-28%	-626	-49%
Poland	4 009	1 942	1 932	10.0%	-2 077	-52%	-11	-1%
Portugal	91	NO	NO	-	-91	-100%	-	-
Romania	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Slovakia	1 319	1 138	1 231	6.4%	-88	-7%	93	8%
Slovenia	37	NO	NO	-	-37	-100%	-	-
Spain	1 809	426	490	2.5%	-1 319	-73%	64	15%
Sweden	300	372	373	1.9%	72	24%	0	0%
EU-27	**88 816**	**21 857**	**19 266**	**100%**	**-69 550**	**-78%**	**-2 591**	**-12%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period

Abbreviations are explained in the Chapter 'Units and abbreviations'.

Austria includes the emissions from 1.A.1.c Solid fuels (occurring in coke ovens) in 1.A.2.a Iron and Steel Industries.

Solid fuels have fallen steadily to one-third of the 1990 levels. The decline in emissions (see Figure 3.32 below) in Germany is mainly due to a large decline in lignite production in the 1990s. Lignite use decreased strongly. From raw lignite, a range of refined products used to be produced for industry, households and small commercial operations. A comprehensive transition from lignite to other fuels then took place until the end of the 1990s.

Figure 3.32 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Solid Fuels: Emission trend and share for CO_2

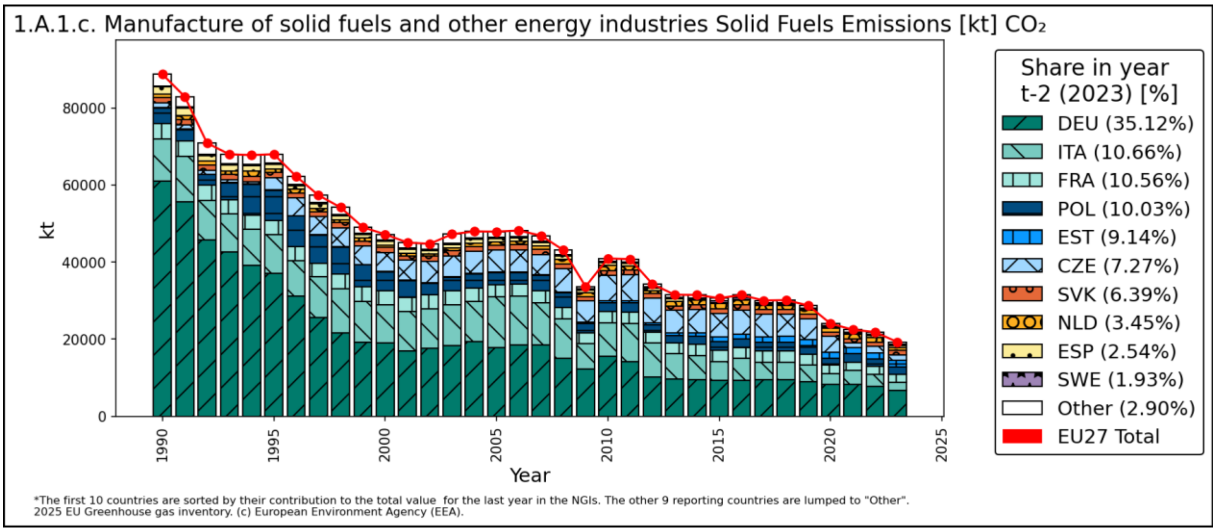
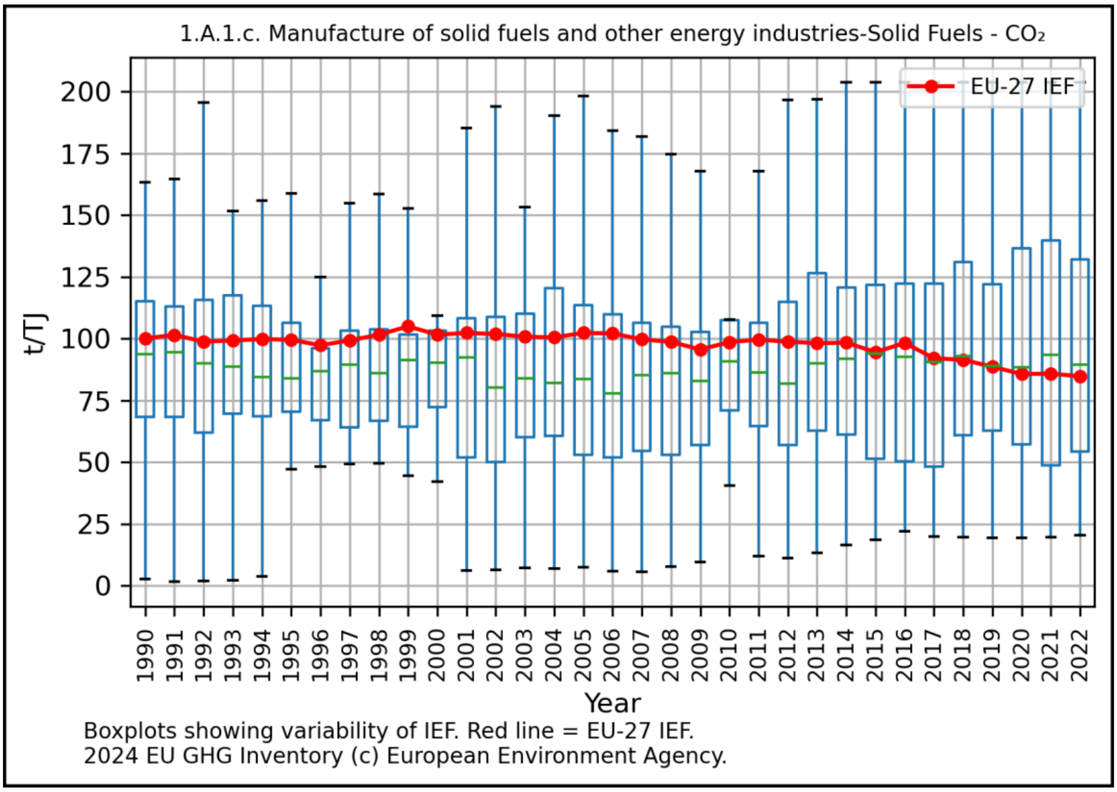


Figure 3.33 shows the relevant implied emission factors for solid fuels. The EU implied emission factor amounted to 78.6 t/TJ in 2023: it is the lowest of the entire time-series.

In general, the variation can be explained by the mix of different fuels and the shifts of their energy consumptions between years.

Figure 3.33 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Solid Fuels: Implied Emission Factors for CO_2



1.A.1.c Manufacture of Solid Fuels and Other Energy Industries – Gaseous Fuels (CO_2)

CO_2 emissions from the combustion of gaseous fuels used in category 1.A.1.c accounted for about 26.1% of total CO_2 emissions from this category in 2023. Emissions in the EU decreased by 12% (Table 3.21 below) between the years 1990 and 2023. After a strong increase in the 1990s and stabilisation in the 2000s there has been a significant reduction in the last few years.

Table 3.21 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Gaseous Fuels: Countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	506	210	155	2.1%	-351	-69%	-55	-26%
Belgium	3	NO	NO	-	-3	-100%	-	-
Bulgaria	NO	1	1	0.0%	1	∞	0	6%
Croatia	875	307	314	4.4%	-560	-64%	8	3%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	NO	6	5	0.1%	5	∞	-1	-14%
Denmark	525	867	796	11.0%	272	52%	-71	-8%
Estonia	IE	IE	IE	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	531	NO	NO	-	-531	-100%	-	-
Germany	2 622	1 310	1 130	15.6%	-1 492	-57%	-181	-14%
Greece	102	4	36	0.5%	-66	-65%	32	755%
Hungary	311	137	142	2.0%	-168	-54%	6	4%
Ireland	IE	4	4	0.1%	4	∞	-1	-12%
Italy	621	1 015	1 255	17.4%	634	102%	240	24%
Latvia	105	21	31	0.4%	-73	-70%	11	51%
Lithuania	NO	45	31	0.4%	31	∞	-14	-31%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	1 184	1 088	945	13.1%	-239	-20%	-143	-13%
Poland	684	1 297	1 458	20.2%	774	113%	161	12%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	IE,NO	180	264	3.7%	264	∞	84	46%
Slovakia	NO	49	36	0.5%	36	∞	-13	-26%
Slovenia	42	0	NO	-	-42	-100%	0	-100%
Spain	89	314	614	8.5%	524	587%	300	96%
Sweden	IE,NO	IE,NO	IE,NO	-	-	-	-	-
EU-27	**8 199**	**6 856**	**7 218**	**100%**	**-981**	**-12%**	**363**	**5%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period

Abbreviations are explained in the Chapter 'Units and abbreviations'.

Estonia includes the emissions from 1.A.1.c in 1A1a.
Sweden includes emissions from 1.A.1.c in 1.A.2.g

Figure 3.34 illustrates the emission trend for gaseous fuels split by countries over the last 33 years. Although the emissions in the year 2023 compared to 1990 decreased by 12% over the whole time series, there was a strong increase in the 1990s and a decline after 2009.

Figure 3.34 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Gaseous Fuels: Emission trend and share for CO_2

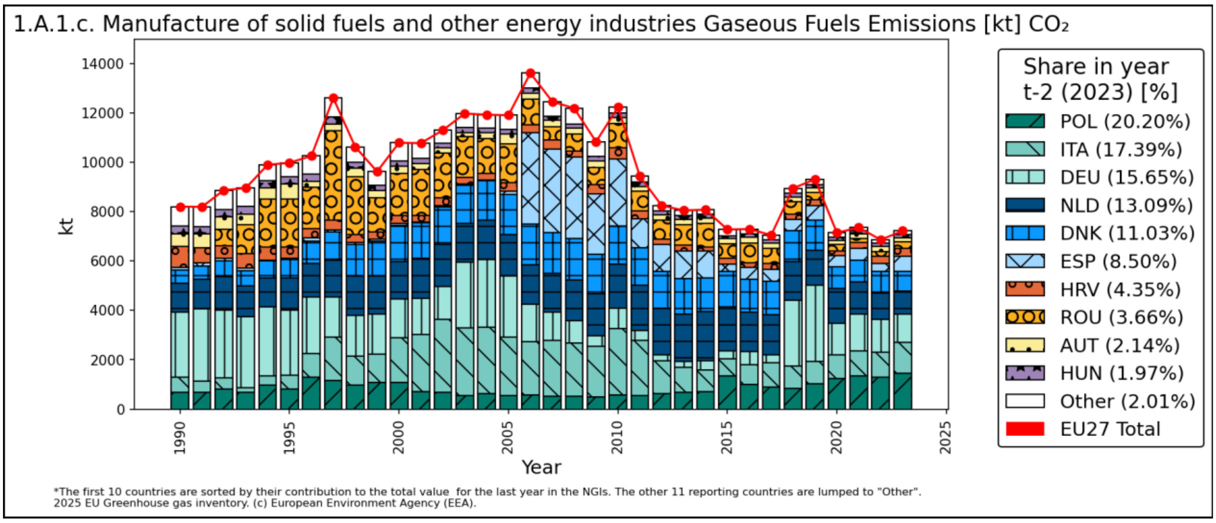
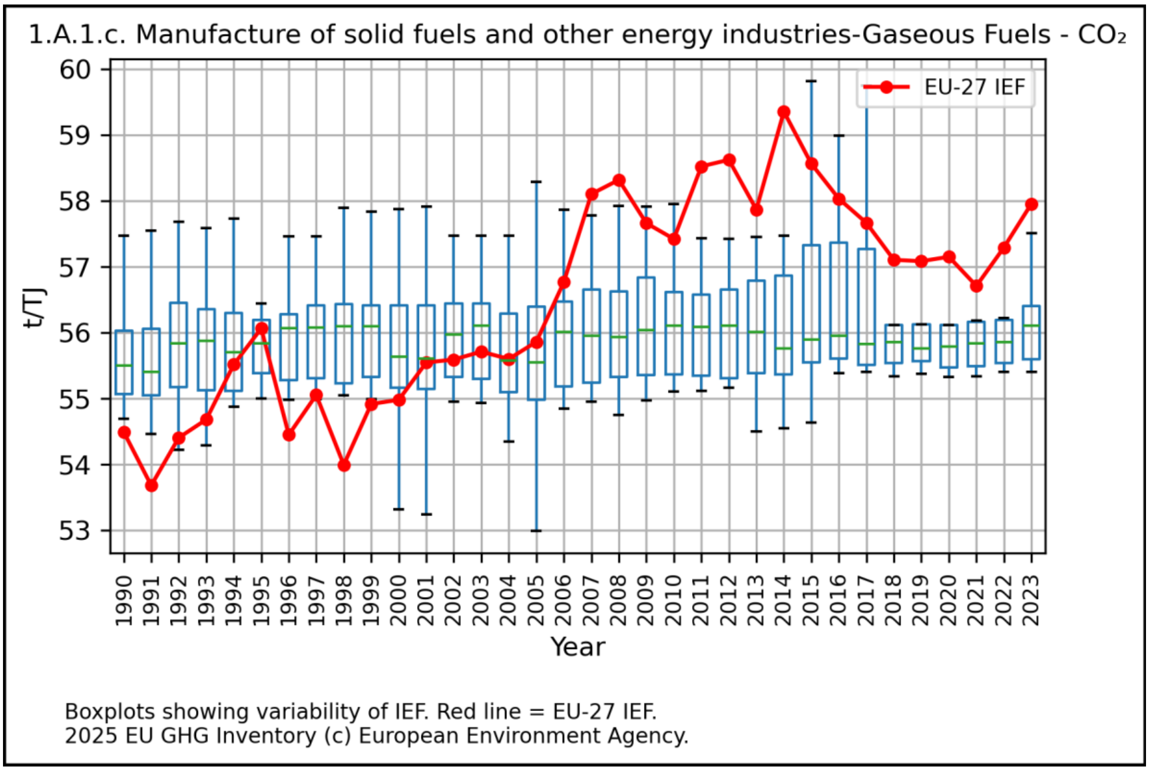


Figure 3.35 (on the next page) shows the implied emission factors for gaseous fuels. The EU implied emission factor is 58.0 t/TJ in 2023 and varies between 55 and 59 t/TJ over the last 33 years. The IPCC default values range between 54.3 t/TJ (lower) and 58.3 t/TJ (upper).

Figure 3.35 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, Gaseous Fuels: Implied Emission Factors for CO_2



3.6.2 Manufacturing industries and construction (CRT Source Category 1.A.2.)

Category 1.A.2 includes emissions from combustion of fuels in manufacturing industries and construction including fuel use of non-public electricity and heat generation (auto producers). According to the guidelines, emissions from fuel combustion in coke oven plants are reported under 1.A.1.c. Austria reports emissions from onsite coke ovens of integrated iron and steel plants under category 1.A.2.a. Some MS report emissions of blast furnace and coke oven gas combustion under categories 1.A.1.a public electricity and heat production or 1.A.4 other sectors and some MS are reporting emissions from refinery gas under 1.A.2. Emissions from category 1.A.2 are specified by the sum of subsectors that correspond to the International Standard Industrial Classification of All Economic Activities (ISIC, see listing below). Emissions from transport used by industry are reported under category 1.A.3 Transport. Most countries report emissions arising from off-road and other mobile machinery used in industry (e.g. construction machinery) under category 1.A.2.g. Emissions from non-energy fuel use (e.g. reducing agents used in blast furnaces or natural gas used for ammonia production) should be reported under category 2 Industrial Processes.

The following enumeration shows the correspondence of 1A2 subcategories and ISIC Rev 3.1 codes:

- 1 A 2 a Iron and Steel: ISIC Group 271 and Class 2731.
- 1 A 2 b Non-Ferrous Metals: ISIC Group 272 and Class 2732.
- 1 A 2 c Chemicals: ISIC Division 24.
- 1 A 2 d Pulp, Paper and Print: ISIC Divisions 21 and 22
- 1 A 2 e Food Processing, Beverages and Tobacco: ISIC Divisions 15 and 16.
- 1 A 2 f Non-metallic Minerals: ISIC Division 26
- 1 A 2 g Other manufacturing industries: ISIC Divisions 17 to 20, 25, 28 to 37 and 45.

The following table shows the share of specific tier methods used for each 1.A.2 category emission estimates. It can be seen that most countries use Tier 2 methodology for emission estimates.

*Table 3.22**:** Share of Tier methods for 1.A.2 by type of reported method and method combinations.*

Methods and method combinations	Share of emissions which are estimated by the specific Tier method'
CS	29.3%
T1	0,7%
T1,T2	11.3%
T1,T3	-
T2	20,8%
T2,T3	0,3%
T3	1.4 %
T1,T2,T3	16.9%
CS,T1	0.2%
Other combination	19.1%

Information about methodology used by countries for calculating emissions from category 1.A.2.g is not included in submission files for specific fuels but only as overall methodology information.

Table 3.23: Key categories for sector 1.A.2. (Table excerpt)

Source category gas	kt CO_2 equivalent		Trend	Level		Share of higher Tiers [%]
	1990	2023		1990	2023	
1.A.2.a. Iron and steel: Gaseous Fuels (CO_2)	29392	15078	T	L	L	99.77
1.A.2.a. Iron and steel: Liquid Fuels (CO_2)	9044	943	T	L	0	99.00
1.A.2.a. Iron and steel: Solid Fuels (CO_2)	112372	51561	T	L	L	99.94
1.A.2.b. Non-ferrous metals: Gaseous Fuels (CO_2)	3013	5668	T	0	L	94.85
1.A.2.c. Chemicals: Gaseous Fuels (CO_2)	49415	28918	0	L	L	99.63
1.A.2.c. Chemicals: Liquid Fuels (CO_2)	29757	9981	T	L	L	88.41
1.A.2.c. Chemicals: Solid Fuels (CO_2)	11978	7252	0	L	L	99.96
1.A.2.d. Pulp, paper and print: Gaseous Fuels (CO_2)	11336	13029	T	L	L	92.61
1.A.2.d. Pulp, paper and print: Liquid Fuels (CO_2)	10835	1340	T	L	0	79.87
1.A.2.d. Pulp, paper and print: Solid Fuels (CO_2)	6761	1033	T	0	0	92.8
1.A.2.e. Food processing, beverages and tobacco: Gaseous Fuels (CO_2)	15813	25992	T	L	L	97.21
1.A.2.e. Food processing, beverages and tobacco: Liquid Fuels (CO_2)	18064	2948	T	L	0	79.86
1.A.2.e. Food processing, beverages and tobacco: Solid Fuels (CO_2)	11557	2820	T	L	0	98.7
1.A.2.f. Non-metallic minerals: Gaseous Fuels (CO_2)	27265	27786	T	L	L	98.85
1.A.2.f. Non-metallic minerals: Liquid Fuels (CO_2)	46179	19657	T	L	L	95.74
1.A.2.f. Non-metallic minerals: Other Fuels (CO_2)	1438	13259	T	0	L	68.37
1.A.2.f. Non-metallic minerals: Solid Fuels (CO_2)	52351	10177	T	L	L	96.75
1.A.2.g. Other: Gaseous Fuels (CO_2)	79964	67434	T	L	L	95.3
1.A.2.g. Other: Liquid Fuels (CO_2)	81677	34765	T	L	L	97.18
1.A.2.g. Other: Other Fuels (CO_2)	2451	4576	T	0	L	92.5
1.A.2.g. Other: Solid Fuels (CO_2)	90603	7532	T	L	L	99.56

In 2023, category 1.A.2 contributed to 363 429,8 kt CO_2 equivalents of which 98.6 % share belongs to CO_2 emissions, 0.8 % to N_2O emissions and 0.6 % to CH_4 emissions. Total CO_2 emissions decreased by 50 % since 1990. Total CO_2 emissions decreased by 7% between 2022 and 2023.

Category 1.A.2 is dominated by CO_2 from category 1.A.2.g Other which contributes to total kt CO_2 equivalents emissions by 32.2 % followed by 1.A.2.f Non-metallic Minerals contributing by 19.9 %, 1.A.2.a Iron and steel contributing by 18.8 %, 1.A.2.c Chemicals by 13.3 %, 1.A.2.e Food processing, beverages and tobacco by 9 %, 1.A.2.d Pulp, paper and print by 4.7 % and 1.A.2.b Non-ferrous metals by 2.1 %. Some Member States do not allocate emissions to all sub-categories under 1.A.2., which is one reason for 1.A.2.g being the largest sub-category within 1.A.2 source category.

Figure 3.36 shows the emission trends within source category 1.A.2. The share of liquid fuels on CO_2 emissions from 1.A.2. decreased from 28% in 1990 to 20 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2. decreased from 41% in 1990 to 23% in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2. increased from 30% in 1990 to 51% in 2023.

For the years 2013 to 2025 Sweden makes excessive use of confidential reporting (Notation key ‘C’), which implies that sub-categories include emissions without providing detailed fuel specific emissions. However, all Swedish confidential emissions are included in the total emissions of 1.A.2 and have been included in ‘other fossil fuels’ of the EU inventory.

Figure 3.36: 1.A.2. Manufacturing Industries and Construction: Total emission trends

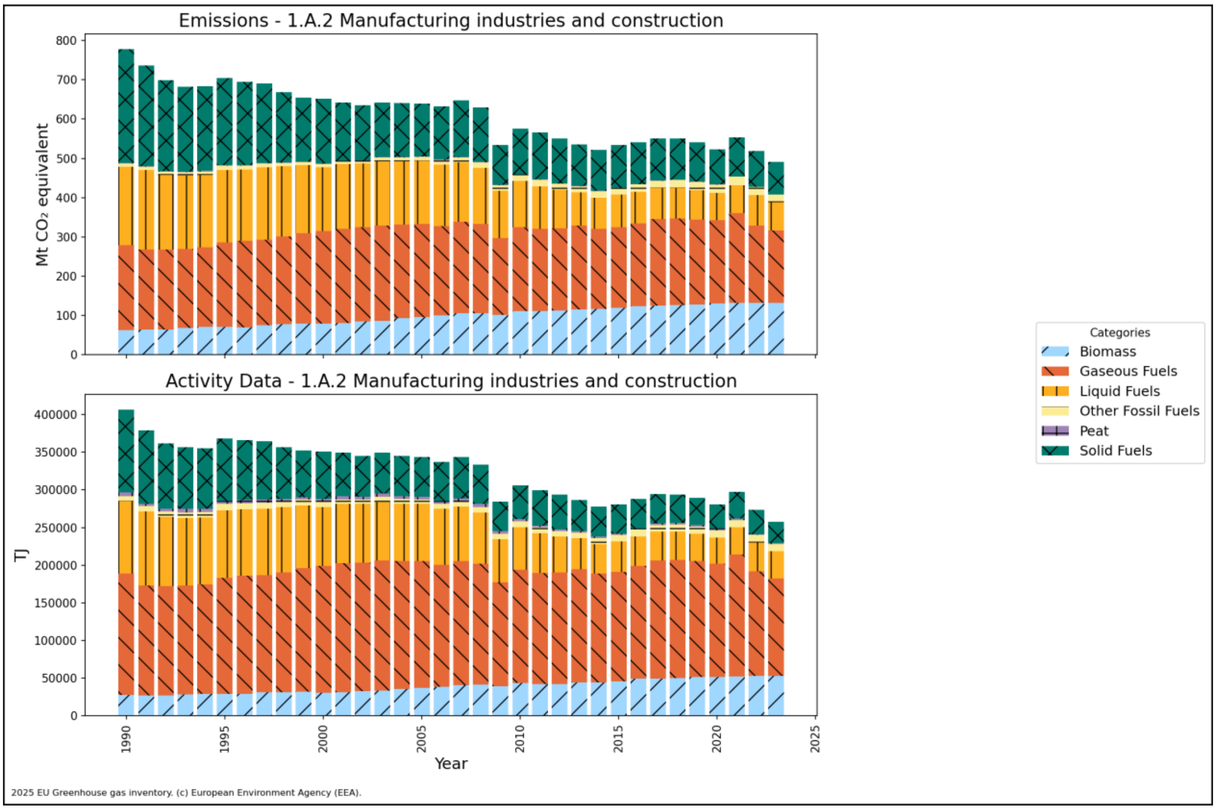


Table 3.23 summarizes information by countries on GHG emissions and CO_2 emissions from 1.A.2 Manufacturing Industries and Construction in 1990 and 2023.

Table 3.24: 1.A.2. Manufacturing Industries and Construction: Member States contributions to total GHG and CO_2 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt	
	1990	**2023**	**1990**	**2023**
Austria	9 609	9 633	9 533	9 499
Belgium	23 604	12 220	23 464	12 080
Bulgaria	17 757	3 828	17 664	3 781
Croatia	5 128	2 451	5 103	2 435
Cyprus	505	566	502	558
Czechia	47 105	10 141	46 824	10 032
Denmark	5 732	3 029	5 668	2 975
Estonia	3 454	228	3 446	227
Finland	13 358	5 052	13 192	4 918
France	64 345	35 935	63 812	35 322
Germany	184 425	105 769	182 953	104 875
Greece	9 400	4 347	9 338	4 299
Hungary	13 509	4 069	13 475	4 028
Ireland	4 075	4 152	4 056	4 135
Italy	92 151	50 489	90 773	49 533
Latvia	3 965	643	3 910	585
Lithuania	6 158	1 087	6 106	1 068
Luxembourg	6 244	902	6 229	880
Malta	53	65	53	65
Netherlands	29 756	17 086	29 658	16 986
Poland	42 831	26 417	42 621	26 157
Portugal	8 994	5 956	8 853	5 786
Romania	54 080	11 471	53 942	11 408
Slovakia	16 095	5 667	16 027	5 627
Slovenia	3 096	1 517	3 067	1 495
Spain	44 880	34 929	44 537	33 893
Sweden	10 786	5 781	10 647	5 658
EU-27	**721 094**	**363 430**	**715 454**	**358 305**

Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.2 Manufacturing Industries and Construction is the fourth largest sector in the EU accounting for 15 % of total GHG emissions from Energy sector in 2023. Between 1990 and 2023, CO_2 emissions from 1.A.2. Manufacturing Industries and Construction declined by 50 %. Decrease of total emissions is caused by decrease of fossil fuel consumption in category 1.A.2. Manufacturing Industries and Construction.

A shift from solid and liquid fuels to mainly natural gas took place and an increase of biomass CO_2 emissions by 110 %.

Decrease of emissions in 2006 to 2008 were influenced by the features of national economy development when in-country industrial production already started to diminish due to increasing costs of the production and dominance of imported products. Crisis in national economy in the second part of

2008 also caused a significant decrease in total emissions. The decline in recent years is caused by restrictions during the COVID and very challenging macroeconomic and geopolitical situation.

3.6.2.1 Iron and Steel (1.A.2.a)

This chapter provides information about European emission trend, Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.a Iron and Steel.

Category 1.A.2.a (more specifically CO_2 emissions from use of gaseous, liquid and solid fuels) was identified as a key category by level and trend and thus the following description focuses only on CO_2 emissions. CO_2 emissions trend and activity data trends can be observed in

Figure 3.37. Detailed data related to countries CO_2 emissions and percentage differences is depicted in Table 3.25. CO_2 emissions have almost 100 % share on total emissions from 1.A.2.a.

Total CO_2 emissions from 1.A.2.a amounted to 67 598 kt CO_2 eq. in 2023. The trend of total CO_2 emissions for 1990 to 2023 from category 1.A.2.a is depicted in Figure 3.37

Total CO_2 emissions decreased by 55 % since 1990, mainly due to improved efficiency of restructured iron and steel plants and ongoing consequences of the economic crisis in 2009. Total CO_2 emissions decreased by 3% between 2022 and 2023. CO_2 emissions from 1.A.2.a Iron and Steel accounted for 18.8% of 1.A.2. source category. The share of liquid fuels on CO_2 emissions from 1.A.2.a decreased from 6% in 1990 to 1.4 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.a was 76% in 2023 and 74% in 1990. The share of gaseous fuels on CO_2 emissions from 1.A.2.a increased from 19% in 1990 to 22% in 2023.

Figure 3.37: 1.A.2.a Iron and Steel: total emissions and activity data trends

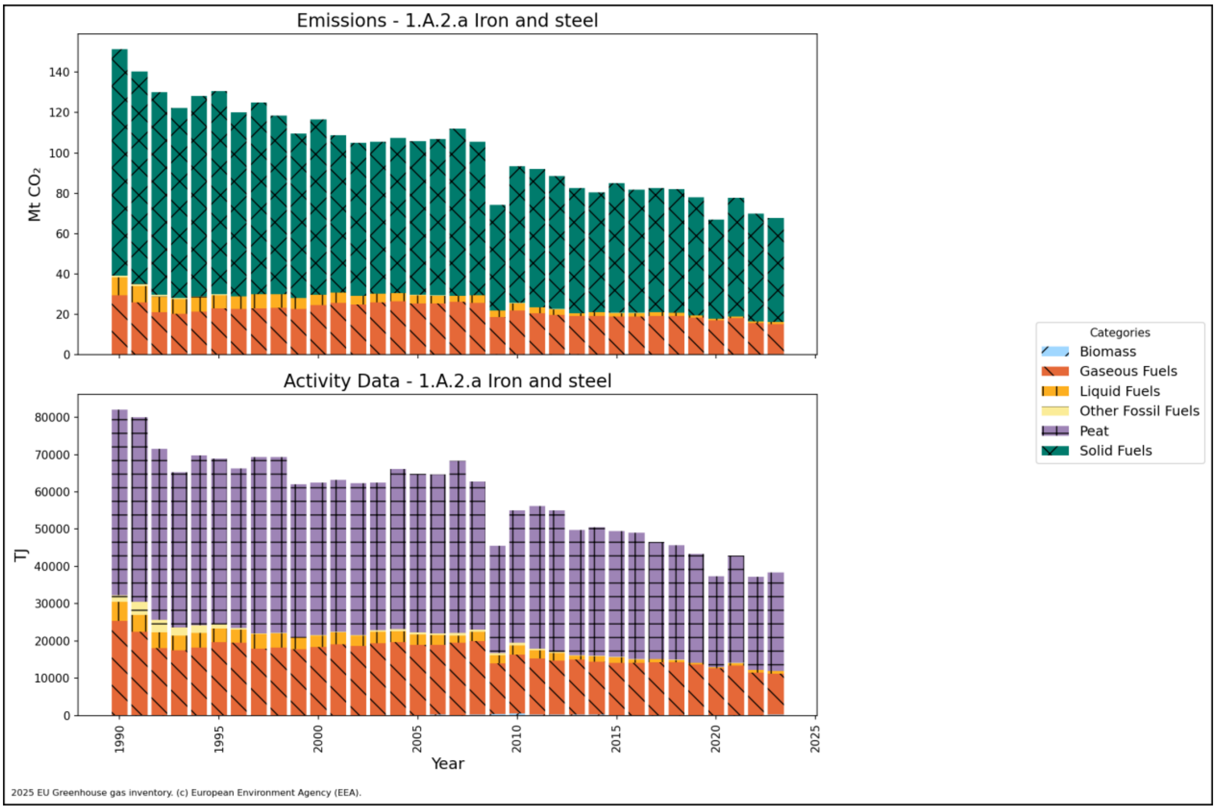


Table 3.25: 1.A.2.a Iron and Steel: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 833	1 773	1 715	2.5%	-118	-6%	-58	-3%	NA,T2	CS,NA
Belgium	5 662	992	1 014	1.5%	-4 648	-82%	21	2%	NA,T1,T3	D,NA,PS
Bulgaria	2 705	111	112	0.2%	-2 594	-96%	1	1%	NA,T1,T2	CS,D,NA
Croatia	1 062	64	65	0.1%	-997	-94%	1	2%	NA,T1	D,NA
Cyprus	1	0	0	0.0%	-1	-96%	0	17%	NA,T1	D,NA
Czechia	14 861	1 622	1 349	2.0%	-13 511	-91%	-273	-17%	NA,T2	CS,D,NA
Denmark	136	81	77	0.1%	-59	-43%	-3	-4%	NA,T2,T3	CS,NA
Estonia	NO	1	0	0.0%	0	∞	0	-31%	NA,T2	CS,NA
Finland	2 499	799	755	1.1%	-1 744	-70%	-44	-6%	NA,T3	CS,NA,PS
France	8 766	3 804	3 308	4.9%	-5 458	-62%	-497	-13%	T2,T3	CS
Germany	35 269	34 291	33 819	50.0%	-1 451	-4%	-472	-1%	CS,NA	CS,NA,NO
Greece	447	123	88	0.1%	-359	-80%	-35	-29%	NA,T2	CS,NA,PS
Hungary	2 524	104	56	0.1%	-2 468	-98%	-48	-46%	NA,T1,T2	CS,D,NA
Ireland	175	2	2	0.0%	-173	-99%	0	0%	NA,T2	CS,NA
Italy	25 255	8 766	9 099	13.5%	-16 156	-64%	333	4%	NA,T2	CS,NA
Latvia	389	1	2	0.0%	-387	-99%	1	233%	NA,T2	CS,NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	5 393	231	236	0.3%	-5 157	-96%	4	2%	NA,T2	CS,NA
Malta	NO	0	0	0.0%	0	∞	0	-5%	NA,T1	D,NA
Netherlands	5 599	4 118	3 607	5.3%	-1 991	-36%	-511	-12%	NA,T2	CS,D,NA
Poland	16 247	3 067	3 222	4.8%	-13 026	-80%	155	5%	NA,T1,T2	CS,D,NA
Portugal	373	96	100	0.1%	-273	-73%	5	5%	NA,NO,T2	R,D,NA,NO,PS
Romania	9 154	1 024	548	0.8%	-8 607	-94%	-476	-47%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	2 682	2 474	2 633	3.9%	-48	-2%	159	6%	NA,T2	CS,NA
Slovenia	423	194	168	0.2%	-256	-60%	-26	-13%	NA,T1,T2	CS,D,NA
Spain	8 303	4 710	4 369	6.5%	-3 934	-47%	-341	-7%	NA,T1,T2,T3	CS,D,NA,PS
Sweden	1 706	1 323	1 253	1.9%	-453	-27%	-71	-5%	T2	CS
EU-27	**151 464**	**69 772**	**67 598**	**100%**	**-83 866**	**-55%**	**-2 174**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.a Iron and Steel - Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.a amounted 943 kt in 2023 for EU. CO_2 emissions decreased compared to the year 1990 by 90 % and decreased by 2 % compared to 2022. This category corresponds to 0.3% share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 62% compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.26.

Table 3.26: 1.A.2.a Iron and Steel, liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	76	18	9	0.9%	-68	-89%	-10	-54%	T2	CS
Belgium	885	31	34	3.6%	-851	-96%	3	10%	T1,T3	D,PS
Bulgaria	37	1	1	0.1%	-37	-98%	0	13%	T1	D
Croatia	208	10	9	0.9%	-199	-96%	-1	-12%	T1	D
Cyprus	1	0	0	0.0%	-1	-96%	0	17%	T1	D
Czechia	427	NO	NO	-	-427	-100%	-	-	NA	NA
Denmark	25	10	9	1.0%	-16	-64%	-1	-8%	T2	CS
Estonia	NO	NO	0	0.0%	0	∞	0	∞	-	-
Finland	305	24	18	1.9%	-287	-94%	-6	-25%	T3	CS
France	1 725	138	137	14.6%	-1 588	-92%	0	0%	T2,T3	CS
Germany	916	11	10	1.1%	-906	-99%	-1	-8%	CS	CS
Greece	447	55	33	3.5%	-415	-93%	-22	-40%	T2	PS
Hungary	583	NO	NO	-	-583	-100%	-	-	NA	NA
Ireland	16	NO	NO	-	-16	-100%	-	-	NA	NA
Italy	156	49	45	4.8%	-111	-71%	-4	-8%	T2	CS
Latvia	92	NO	2	0.2%	-90	-98%	2	∞	T2	CS
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	37	NO	NO	-	-37	-100%	-	-	NA	NA
Malta	NO	0	0	0.0%	0	∞	0	-5%	T1	D
Netherlands	19	7	8	0.8%	-11	-58%	0	6%	T2	CS,D
Poland	870	14	17	1.8%	-853	-98%	3	21%	T1,T2	CS,D
Portugal	109	0	0	0.0%	-109	-100%	0	-15%	T2	CR,D,PS
Romania	NO	1	0	0.0%	0	∞	0	-84%	T1,T2,T3	CS,D,PS
Slovakia	164	2	2	0.2%	-162	-99%	0	-17%	T2	CS
Slovenia	54	2	5	0.5%	-50	-91%	3	131%	T1,T2	CS,D
Spain	1 059	39	36	3.8%	-1 023	-97%	-3	-8%	T1,T2,T3	CS,D,PS
Sweden	831	555	569	60.3%	-262	-32%	14	2%	T2	CS
EU-27	**9 044**	**967**	**943**	**100%**	**-8 101**	**-90%**	**-24**	**-2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.38 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.38: 1.A.2.a Iron and Steel, Liquid fuels: Emission trend and share for CO_2

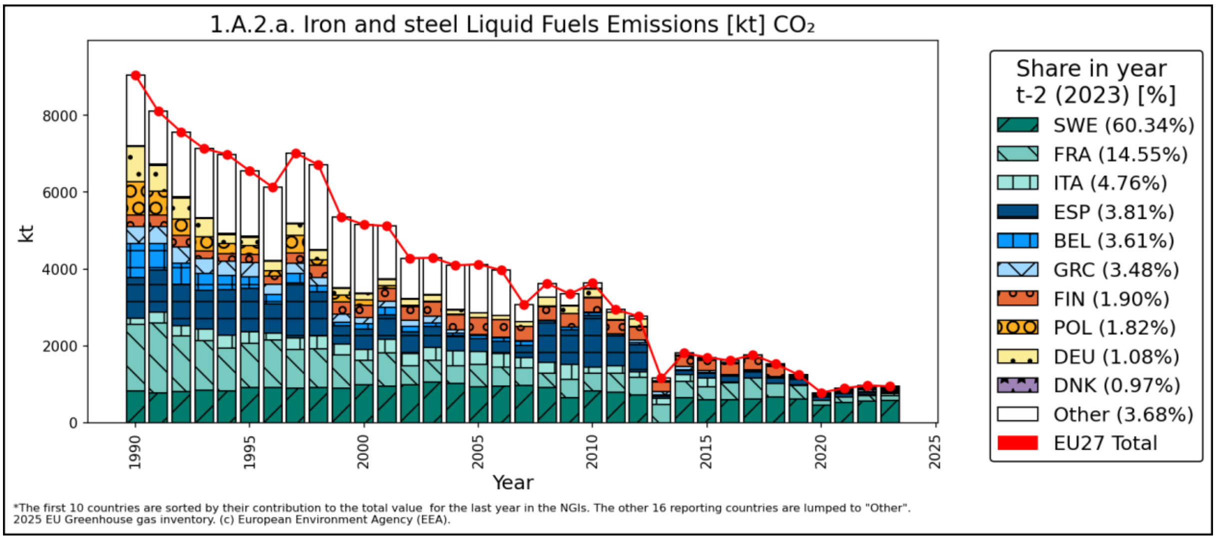
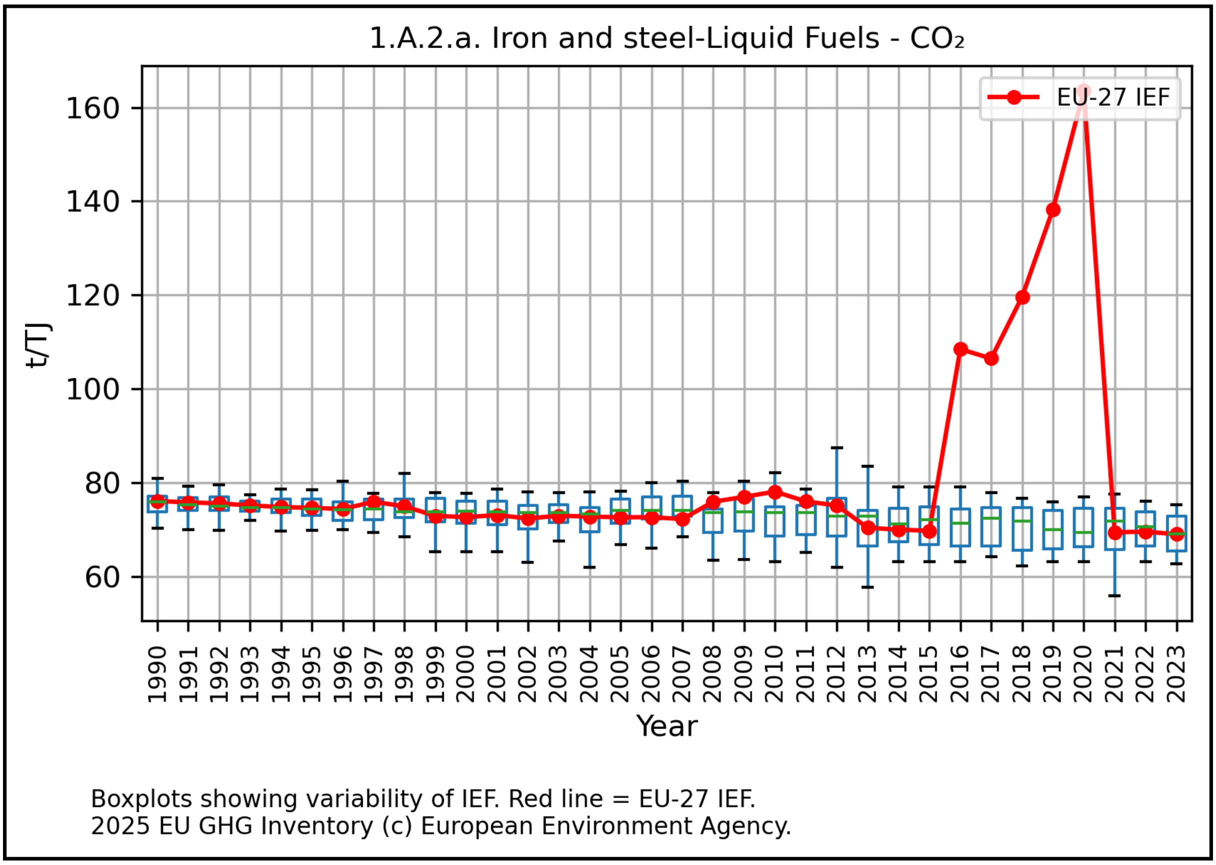


Figure 3.39 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. In the graph, data from Sweden aren't included due to reported confidential data in years 2015-2020, this probable influence the trend of EU IEF as the steep increase occurred exactly in the same period. Sweden has the 60 % share in EU sector total. The EU CO_2 IEF equaled 69.08 t/TJ in 2023 excluding Sweden.

Figure 3.39: 1.A.2.a Iron and Steel, Liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



Note: The EU IEF for CO_2 emissions of category 1.A.2.a. liquid fuels displayed in this graph does not include data from SWE due to reported confidential data.

1.A.2.a Iron and Steel - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.a amounted 51 561 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 54 % and decreased compared to 2022 by 3 %. This category represents 14 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 60 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.27.

Table 3.27: 1.A.2.a Iron and Steel, solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 107	708	632	1.2%	-475	-43%	-76	-11%	T2	CS
Belgium	3 284	16	14	0.0%	-3 270	-100%	-2	-15%	T3	PS
Bulgaria	1 631	0	NO	-	-1 631	-100%	0	-100%	NA	NA
Croatia	625	13	14	0.0%	-611	-98%	1	9%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	13 709	1 249	1 004	1.9%	-12 704	-93%	-244	-20%	T2	CS,D
Denmark	5	NO	NO	-	-5	-100%	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	2 084	443	411	0.8%	-1 673	-80%	-31	-7%	T3	CS,PS
France	4 253	1 877	1 559	3.0%	-2 695	-63%	-319	-17%	T2,T3	CS
Germany	29 912	31 822	31 169	60.5%	1 257	4%	-653	-2%	CS	CS
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	629	26	5	0.0%	-624	-99%	-21	-81%	T1,T2	CS,D
Ireland	115	NO	NO	-	-115	-100%	-	-	NA	NA
Italy	20 762	5 009	5 493	10.7%	-15 269	-74%	483	10%	T2	CS
Latvia	NO	0	NO	-	-	-	0	-100%	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	4 959	NO	NO	-	-4 959	-100%	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	4 913	3 591	3 149	6.1%	-1 764	-36%	-442	-12%	T2	CS
Poland	11 870	2 148	2 194	4.3%	-9 676	-82%	46	2%	T1,T2	CS,D
Portugal	264	NO	NO	-	-264	-100%	-	-	NA	NA
Romania	2 599	115	81	0.2%	-2 517	-97%	-33	-29%	T1,T2	CS,D
Slovakia	2 296	2 346	2 484	4.8%	188	8%	138	6%	T2	CS
Slovenia	57	18	14	0.0%	-43	-75%	-4	-22%	T1	D
Spain	6 449	3 221	2 773	5.4%	-3 676	-57%	-448	-14%	T1,T2,T3	CS,PS
Sweden	850	617	563	1.1%	-286	-34%	-53	-9%	T2	CS
EU-27	**112 372**	**53 221**	**51 561**	**100%**	**-60 811**	**-54%**	**-1 660**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.40 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.40: 1.A.2.a Iron and Steel, solid fuels: Emission trend and share for CO_2

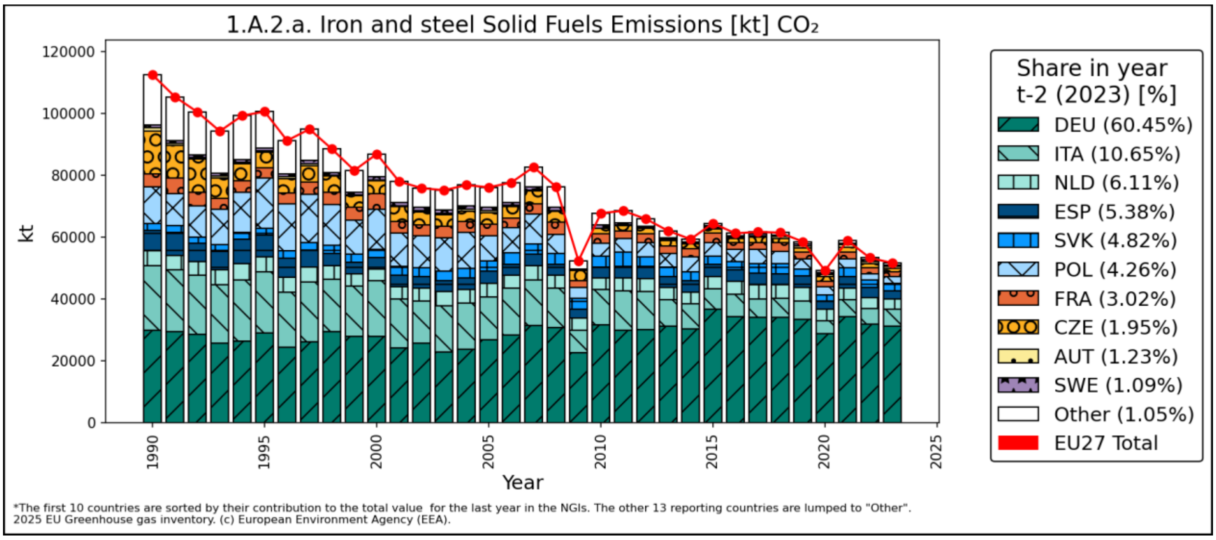
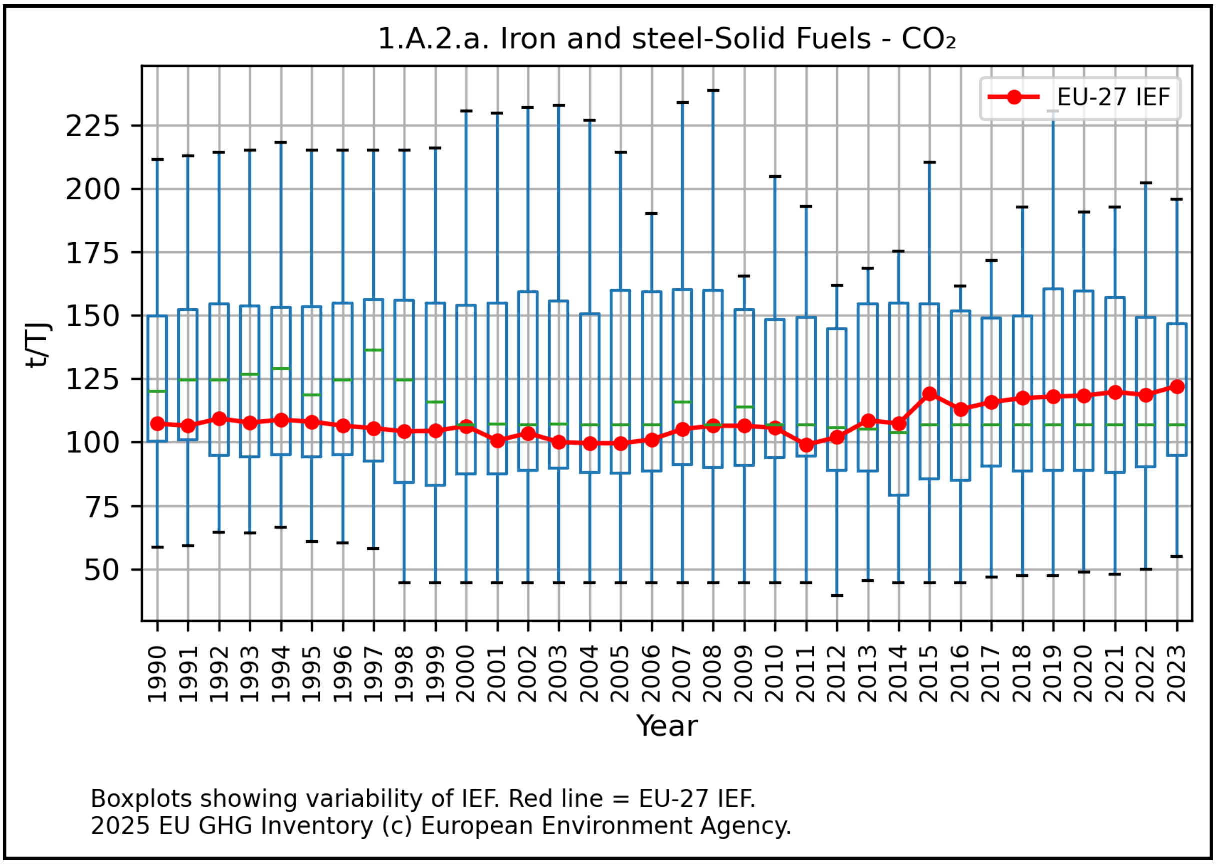


Figure 3.41 shows implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that CO_2 IEF fluctuate during the whole time series. CO_2 IEF equalled to 122.14 t/TJ in 2023.

Figure 3.41: 1.A.2.a Iron and Steel, Solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.a Iron and Steel - Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.a amounted 15 078 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 49 % and decreased compared to 2022 by 3 %. This category represents 4 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 50 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.28.

Table 3.28: 1.A.2.a Iron and Steel, gaseous fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	650	1 047	1 075	7.1%	425	65%	28	3%	T2	CS
Belgium	1 493	940	961	6.4%	-532	-36%	21	2%	T1,T3	D,PS
Bulgaria	1 037	110	111	0.7%	-926	-89%	1	1%	T2	CS
Croatia	229	40	35	0.2%	-194	-85%	-5	-12%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	724	373	345	2.3%	-379	-52%	-28	-8%	T2	CS
Denmark	106	71	68	0.5%	-38	-36%	-2	-4%	T3	CS
Estonia	NO	1	0	0.0%	0	∞	0	-32%	T2	CS
Finland	110	333	326	2.2%	216	197%	-7	-2%	T3	CS
France	2 777	1 788	1 608	10.7%	-1 168	-42%	-179	-10%	T2,T3	CS
Germany	4 442	2 457	2 639	17.5%	-1 802	-41%	182	7%	CS	CS
Greece	NO	68	55	0.4%	55	∞	-13	-19%	T2	CS
Hungary	1 312	78	51	0.3%	-1 260	-96%	-27	-34%	T2	CS
Ireland	44	2	2	0.0%	-41	-95%	0	0%	T2	CS
Italy	4 338	3 708	3 561	23.6%	-776	-18%	-146	-4%	T2	CS
Latvia	236	0	0	0.0%	-235	-100%	0	50%	T2	CS
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	397	231	236	1.6%	-161	-41%	4	2%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	667	519	451	3.0%	-216	-32%	-69	-13%	T2	CS
Poland	2 924	904	1 010	6.7%	-1 914	-65%	106	12%	T2	CS
Portugal	NO	96	100	0.7%	100	∞	5	5%	T2	CR,D,PS
Romania	6 556	908	465	3.1%	-6 090	-93%	-443	-49%	T2,T3	CS,PS
Slovakia	221	125	147	1.0%	-74	-34%	22	17%	T2	CS
Slovenia	312	173	149	1.0%	-163	-52%	-25	-14%	T2	CS
Spain	795	1 451	1 560	10.3%	765	96%	109	8%	T2,T3	CS,PS
Sweden	25	150	120	0.8%	95	377%	-30	-20%	T2	CS
EU-27	**29 392**	**15 576**	**15 078**	**100%**	**-14 314**	**-49%**	**-497**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.42 shows CO_2 emissions trend as well as the share of countries with the highest contribution to the total CO_2 emissions.

Figure 3.42: 1.A.2.a Iron and Steel, Gaseous fuels: Emission trend and share for CO_2

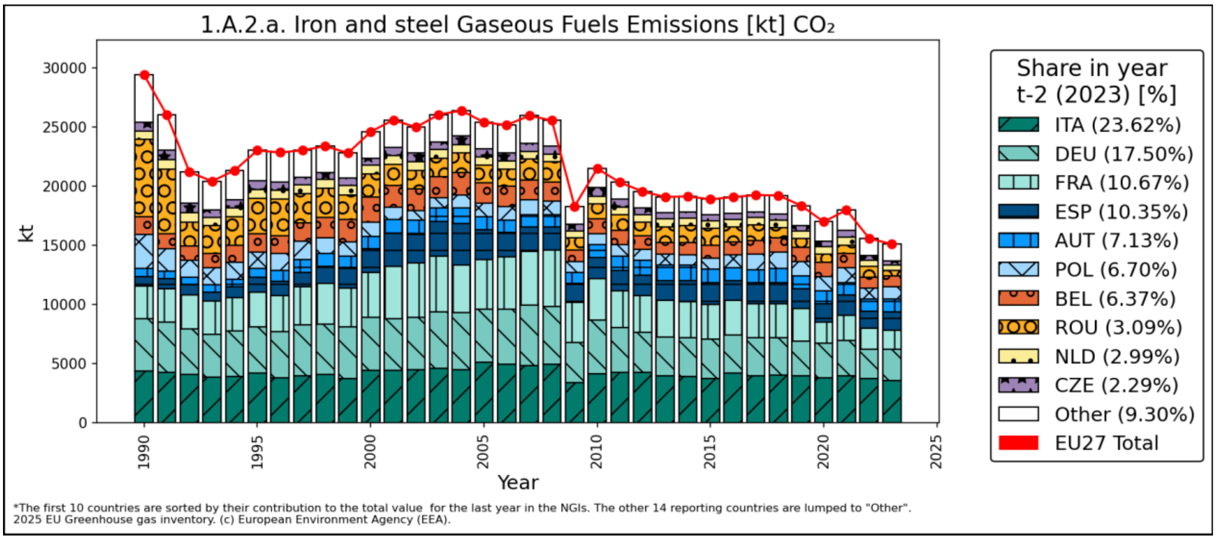
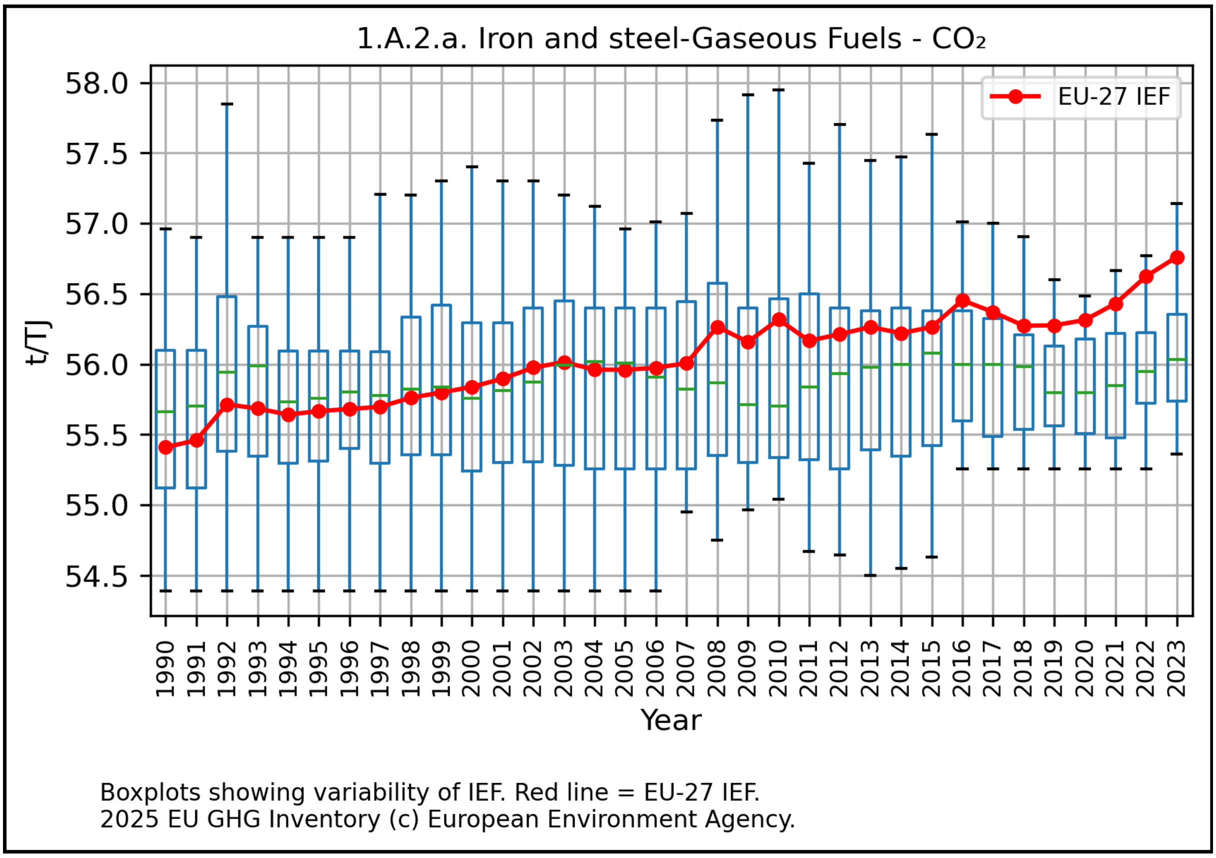


Figure 3.43 shows implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that the CO_2 IEF gradually increases over the entire period of interest. CO_2 IEF equaled to 56.76 t/TJ in 2023.

Figure 3.43: 1.A.2.a Iron and Steel, Gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



3.6.2.2 Non-Ferrous Metals (1.A.2.b)

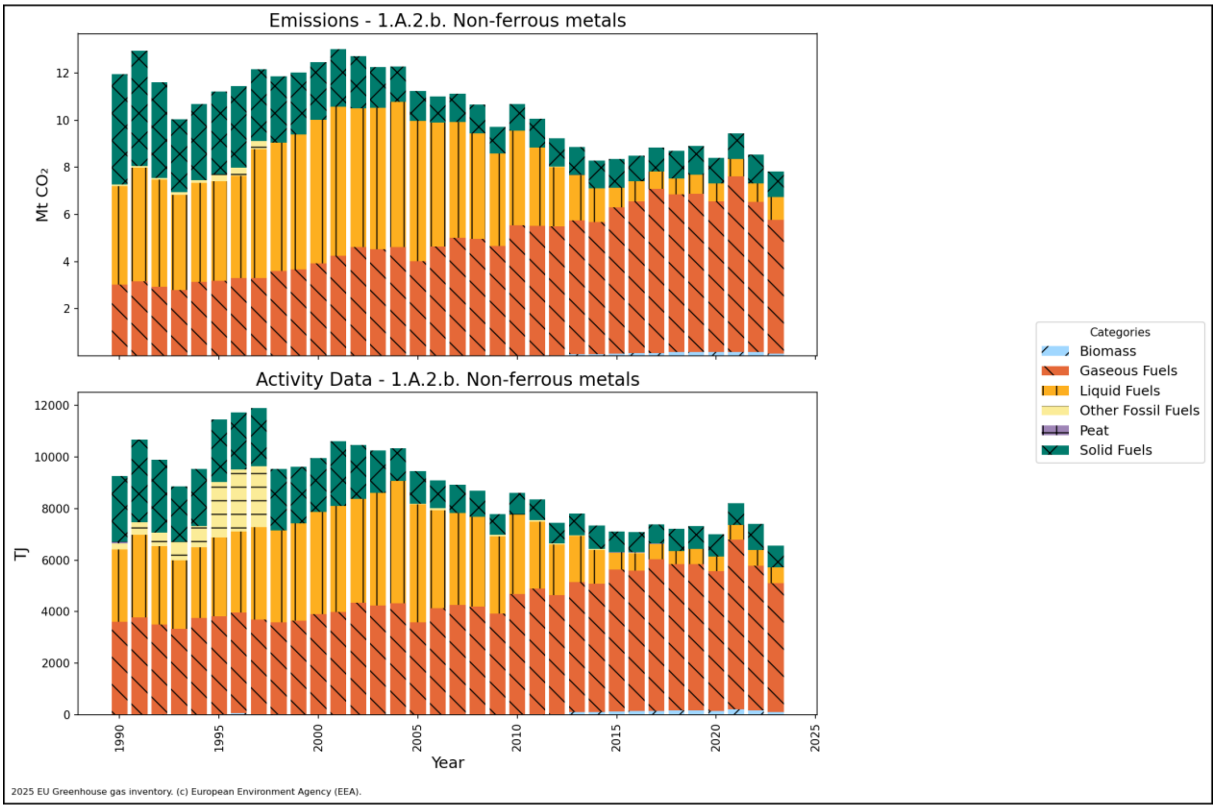
This chapter provides information about European emission trend, Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.b Non-Ferrous Metals.

Total CO_2 emissions from 1.A.2.b amounted to 7 721 kt CO_2 eq. in 2023. The trend of total emissions for 1990 to 2023 from category 1.A.2.b is depicted in Figure 3.44.

Total CO_2 emissions decreased by 35 % since 1990 and decreased by 8 % between 2022 and 2023. Total CO_2 emissions from 1.A.2.b Non-Ferrous Metals accounted for 2 % of 1.A.2. source category.

Figure 3.44 shows the emission trend within the category 1.A.2.b, which is dominated by CO_2 emissions from gaseous fuels in 2023. The share of liquid fuels on CO_2 emissions from 1.A.2.b decreased from 35% in 1990 to 13 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.b decreased from 39% in 1990 to 14 % in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2.b increased from 25% in 1990 to 73 % in 2023.

Figure 3.44: 1.A.2.b Non-ferrous Metals: total emissions and activity data trends



Detailed data related to the EU submissions are depicted in Table.3.29.

Table.3.29: 1.A.2.b Non-ferrous Metals: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	132	309	282	3.7%	150	114%	-27	-9%	NA,T2	CS,NA
Belgium	629	398	472	6.1%	-157	-25%	74	19%	NA,T1	D,NA
Bulgaria	299	254	240	3.1%	-59	-20%	-15	-6%	NA,T1,T2	CS,D,NA
Croatia	17	31	30	0.4%	12	72%	-1	-4%	NA,T1	D,NA
Cyprus	4	2	2	0.0%	-2	-55%	0	-12%	NA,T1	D,NA
Czechia	102	148	140	1.8%	38	37%	-9	-6%	NA,T2	CS,D,NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	1	0.0%	1	∞	1	∞	NA,T1,T2	CS,D,NA
Finland	338	87	90	1.2%	-248	-73%	3	3%	NA,T3	CS,NA
France	2 257	751	662	8.6%	-1 595	-71%	-89	-12%	T2	CS
Germany	1 377	132	162	2.1%	-1 214	-88%	31	23%	CS,NA	CS,NA
Greece	582	558	620	8.0%	38	6%	62	11%	NA,T2	CS,NA,PS
Hungary	301	161	149	1.9%	-152	-50%	-12	-7%	NA,T1,T2	CS,D,NA
Ireland	809	1 252	1 182	15.3%	373	46%	-70	-6%	NA,T1,T2,T3	CS,D,NA
Italy	735	1 133	1 086	14.1%	351	48%	-47	-4%	NA,T2	CS,NA
Latvia	NO	0	2	0.0%	2	∞	1	290%	NA,T2	CS,NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	28	48	42	0.5%	14	47%	-6	-12%	NA,T2	CS,NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	214	144	101	1.3%	-112	-53%	-43	-30%	NA,T2	CS,NA
Poland	1 053	1 213	1 014	13.1%	-39	-4%	-199	-16%	NA,T1,T2	CS,D,NA
Portugal	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NO	NO
Romania	81	196	195	2.5%	114	140%	-1	-1%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	1 256	79	49	0.6%	-1 207	-96%	-30	-38%	NA,T2	CS,NA
Slovenia	440	133	120	1.6%	-320	-73%	-12	-9%	NA,T1,T2	CS,D,NA
Spain	1 178	1 241	977	12.7%	-201	-17%	-264	-21%	NA,T1,T2,T3	CS,D,NA,PS
Sweden	129	99	104	1.3%	-25	-20%	4	5%	T2	CS
EU-27	**11 961**	**8 369**	**7 721**	**100%**	**-4 240**	**-35%**	**-648**	**-8%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period Portugal include emissions under 1.A.2.g. Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.b Non-Ferrous Metals - Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.b amounted 987 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 76 % and compared to 2022 increased by 26 %. Category has 0.3 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 77 % compared to 1990. The category was not identified as a key category for this submission but it was identified in previous submissions and thus the description of the category is still included in the reporting.

Detailed data related to the EU submissions are depicted in *Table 3.30*.

Table 3.30: 1.A.2.b Non-ferrous Metals, liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	35	9	9	0.9%	-26	-74%	0	2%	T2	CS
Belgium	220	43	44	4.5%	-176	-80%	1	2%	T1	D
Bulgaria	199	41	50	5.1%	-149	-75%	9	23%	T1	D
Croatia	17	4	5	0.5%	-12	-71%	1	23%	T1	D
Cyprus	4	2	2	0.2%	-2	-55%	0	-12%	T1	D
Czechia	3	NO	NO	-	-3	-100%	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	1	0.1%	1	∞	1	∞	T1,T2	CS,D
Finland	174	71	68	6.9%	-106	-61%	-3	-4%	T3	CS
France	570	216	181	18.3%	-389	-68%	-35	-16%	T2	CS
Germany	144	111	110	11.2%	-33	-23%	0	0%	CS	CS
Greece	582	16	15	1.6%	-567	-97%	-1	-5%	T2	PS
Hungary	202	NO	3	0.3%	-199	-99%	3	∞	T1	D
Ireland	766	17	14	1.4%	-753	-98%	-3	-19%	T1,T3	CS,D
Italy	18	19	22	2.2%	4	23%	3	16%	T2	CS
Latvia	NO	NO	0	0.0%	0	∞	0	∞	T2	CS
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	15	NO	NO	-	-15	-100%	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	62	25	25	2.6%	-37	-60%	0	1%	T1,T2	CS,D
Portugal	IE	IE	IE	-	-	-	-	-	NO	NO
Romania	IE	2	1	0.1%	1	∞	-1	-56%	T1,T2	CS,D
Slovakia	23	3	2	0.2%	-21	-93%	-1	-46%	T2	CS
Slovenia	121	9	8	0.8%	-113	-93%	0	-4%	T1,T2	CS,D
Spain	923	115	339	34.4%	-584	-63%	224	195%	T1,T2,T3	CS,D,PS
Sweden	110	83	87	8.8%	-23	-21%	4	5%	T2	CS
EU-27	**4 190**	**786**	**987**	**100%**	**-3 203**	**-76%**	**201**	**26%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Portugal includes emissions under 1.A.2.g. Romania includes emissions under 1.A.2.a from 1990 to 2017 (except 2007).
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.45 shows CO_2 emissions trend as well as the share of the Member States with the highest contribution to the total CO_2 emissions.

Figure 3.45: 1.A.2.b Non-ferrous Metals, liquid fuels: Emission trend and share for CO_2

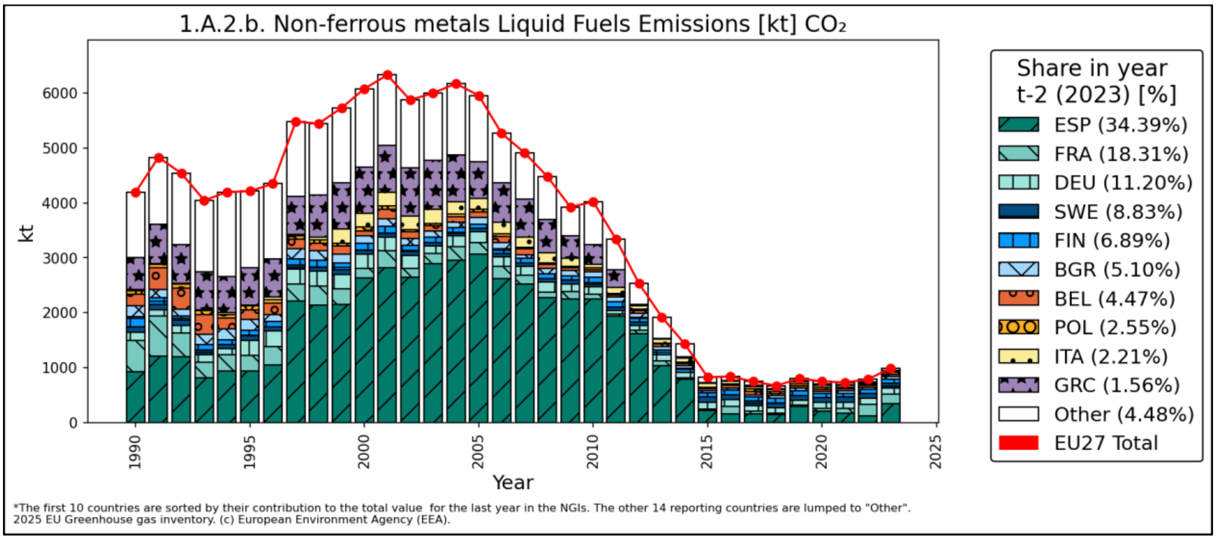
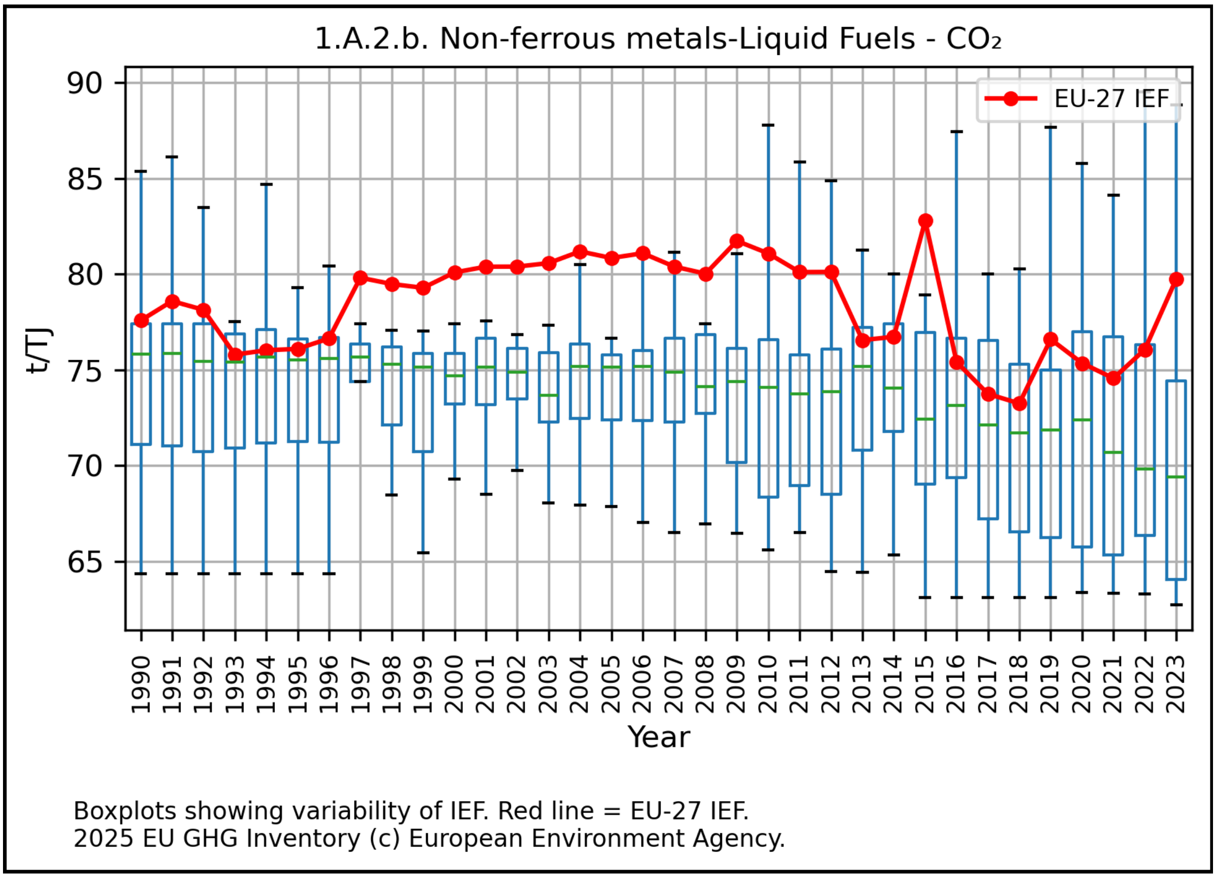


Figure 3.46 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that CO_2 IEF fluctuated at the beginning of the time series and since 2013 shows major fluctuations. The peak in the 2015 implied emission factor, as presented in the figure below, occurs because Sweden reported activity data as confidential. Increase in the EU IEF in 2023 is probably influenced by increase in Spain fuel consumption from 1488 TJ in year 2022 to 3681 TJ in year 2023 and also increase of Spain IEF, Spain has 34 % share in sector total. CO_2 IEF equalled to 81.02 t/TJ in 2023.

Figure 3.46: 1.A.2.b Non-ferrous Metals, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.b Non-Ferrous Metals - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.b amounted 1 066 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 77 % and compared to 2022 decreased by 13 %. Category has 0.3 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 78 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.31.

Table 3.31: 1.A.2.b Non-ferrous Metals, solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	22	12	12	1.1%	-10	-46%	0	0%	T2	CS
Belgium	147	78	160	15.1%	13	9%	83	106%	T1	D
Bulgaria	76	103	94	8.8%	18	23%	-9	-9%	T1,T2	CS,D
Croatia	0	NO	NO	-	0	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	46	15	14	1.3%	-32	-69%	-1	-9%	T2	CS,D
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	155	14	22	2.0%	-134	-86%	8	59%	T3	CS
France	942	5	6	0.5%	-936	-99%	1	11%	T2	CS
Germany	1 233	21	52	4.9%	-1 181	-96%	31	148%	CS	CS
Greece	IE	IE	IE	-	-	-	-	-	NA	NA
Hungary	12	NO	NO	-	-12	-100%	-	-	NA	NA
Ireland	4	NO	NO	-	-4	-100%	-	-	NA	NA
Italy	152	47	43	4.1%	-108	-71%	-4	-8%	T2	CS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	0	NO	NO	-	0	-100%	-	-	NA	NA
Poland	673	780	591	55.5%	-82	-12%	-189	-24%	T1,T2	CS,D
Portugal	IE	IE	IE	-	-	-	-	-	NO	NO
Romania	81	IE	IE	-	-81	-100%	-	-	NA	NA
Slovakia	798	22	5	0.5%	-793	-99%	-16	-75%	T2	CS
Slovenia	154	3	3	0.3%	-152	-98%	0	0%	T1,T2	CS,D
Spain	182	122	63	5.9%	-118	-65%	-59	-48%	T1,T2	CS,D
Sweden	8	NO	NO	-	-8	-100%	-	-	-	-
EU-27	**4 687**	**1 221**	**1 066**	**100%**	**-3 622**	**-77%**	**-155**	**-13%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Portugal includes emissions under 1.A.2.g. From 1991, Romania includes emissions under 1.A.2.a.
Greece includes emissions in the Industrial processes sector (as non-energy use of fuels).
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.47 shows CO_2 emissions trend as well as the share of countries with the highest contribution to the total CO_2 emissions

Figure 3.47: 1.A.2.b Non-ferrous Metals, solid fuels: Emission trend and share for CO_2

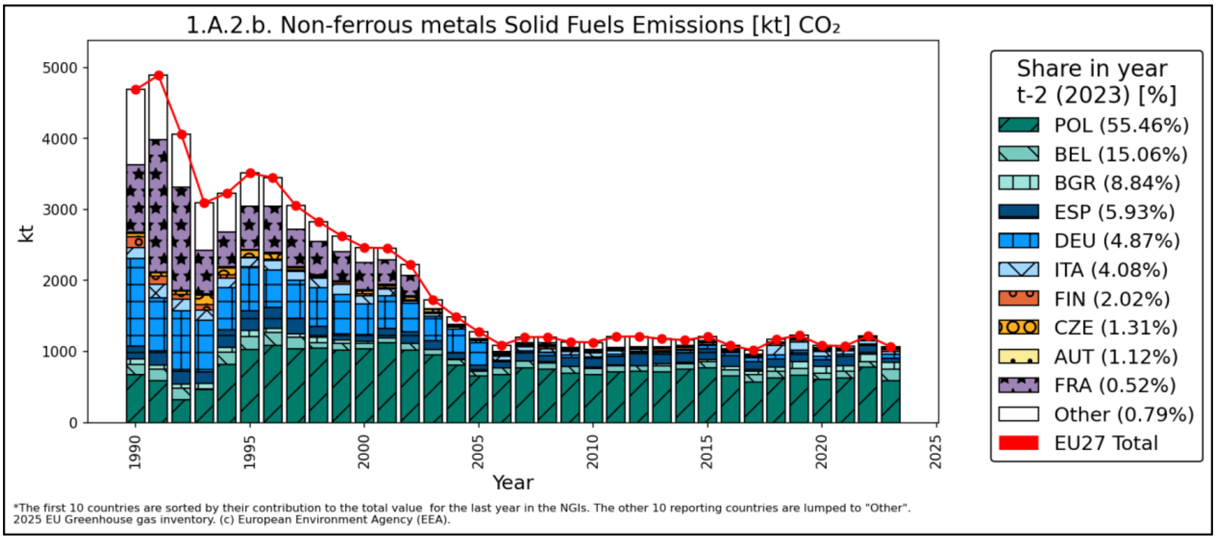
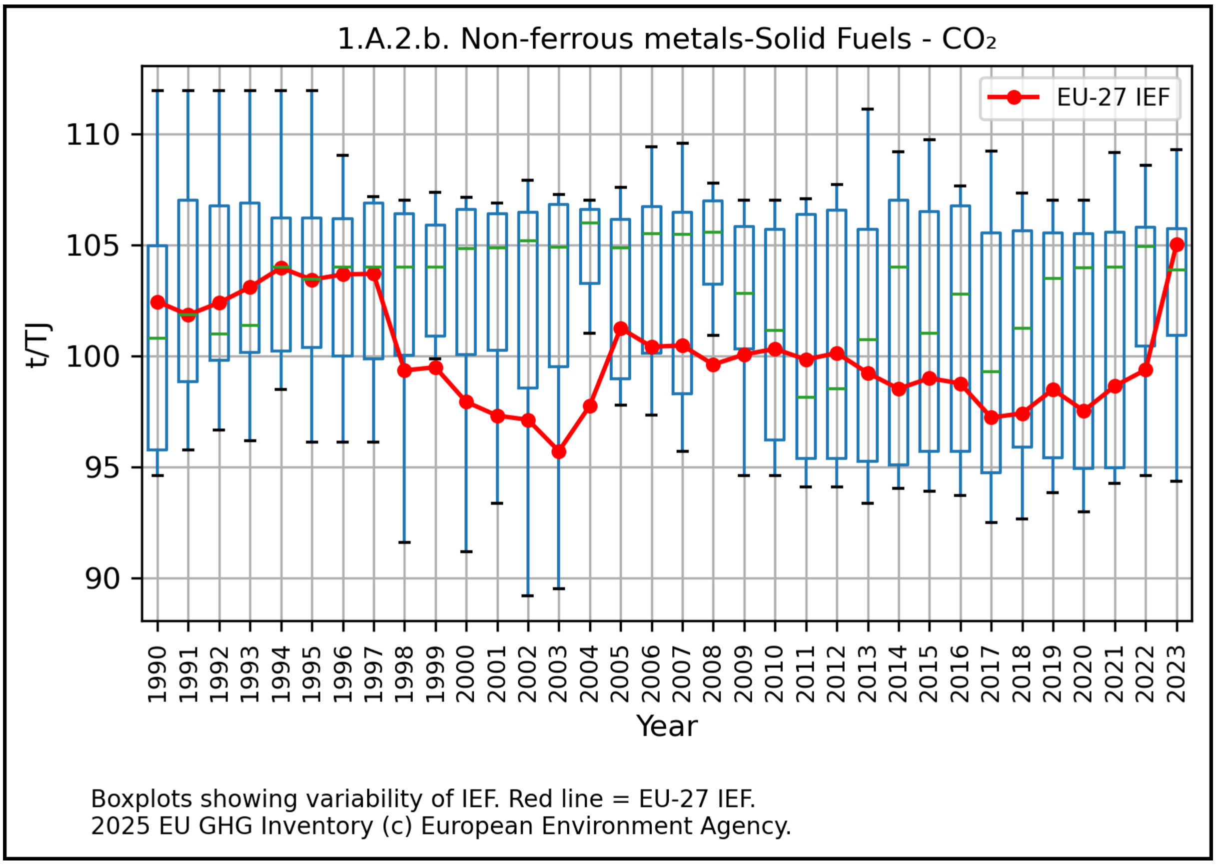


Figure 3.48 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF equalled to 105.11 t/TJ in 2023. The steep increase in IEF in year 2023 is due to the very high IEF of Belgium (mistake in CRTs for year 2023) that has the second highest share in EU in this subsector.

Figure 3.48: 1.A.2.b Non-ferrous Metals, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.b Non-Ferrous Metals - Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.b amounted 5 668 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 88 % and compared to year 2022 decreased by 11 %. This category represents 1.6 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 90 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.32.

Table 3.32: 1.A.2.b Non-ferrous Metals, gaseous fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	75	287	260	4.6%	186	247%	-27	-9%	T2	CS
Belgium	261	277	267	4.7%	6	2%	-10	-3%	T1	D
Bulgaria	23	110	95	1.7%	72	308%	-15	-13%	T2	CS
Croatia	NO	27	25	0.4%	25	∞	-2	-8%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	53	133	126	2.2%	72	136%	-7	-6%	T2	CS
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	3	0	0.0%	0	∞	-2	-96%	T3	CS
France	745	530	476	8.4%	-270	-36%	-55	-10%	T2	CS
Germany	IE	IE	IE	-	-	-	-	-	CS	CS
Greece	NO	542	605	10.7%	605	∞	63	12%	T2	CS
Hungary	86	161	147	2.6%	60	69%	-15	-9%	T2	CS
Ireland	39	1 235	1 168	20.6%	1 130	2930%	-66	-5%	T2	CS
Italy	566	1 067	1 021	18.0%	455	80%	-46	-4%	T2	CS
Latvia	NO	0	2	0.0%	2	∞	1	278%	T2	CS
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	13	48	42	0.7%	29	213%	-6	-12%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	213	144	101	1.8%	-112	-52%	-43	-30%	T2	CS
Poland	254	408	397	7.0%	143	56%	-11	-3%	T2	CS
Portugal	IE	IE	IE	-	-	-	-	-	NO	NO
Romania	IE	194	194	3.4%	194	∞	0	0%	T2,T3	CS,PS
Slovakia	435	54	42	0.7%	-393	-90%	-12	-23%	T2	CS
Slovenia	165	121	109	1.9%	-55	-34%	-12	-10%	T2	CS
Spain	73	1 005	575	10.1%	501	684%	-430	-43%	T2,T3	CS,PS
Sweden	10	16	17	0.3%	6	58%	1	4%	T2	CS
EU-27	**3 013**	**6 362**	**5 668**	**100%**	**2 655**	**88%**	**-694**	**-11%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Portugal includes emissions under 1.A.2.g. From 1990 to 2017, Romania includes emissions under 1.A.2.a.
Germany reported emissions under 1.A.2.g (unspecified industrial power plants) because of confidential data.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.49 shows CO_2 emissions trend as well as the share of countries with the highest contribution to the total CO_2 emissions.

Figure 3.49: 1.A.2.b Non-ferrous Metals, Gaseous fuels: Emission trend and share for CO_2

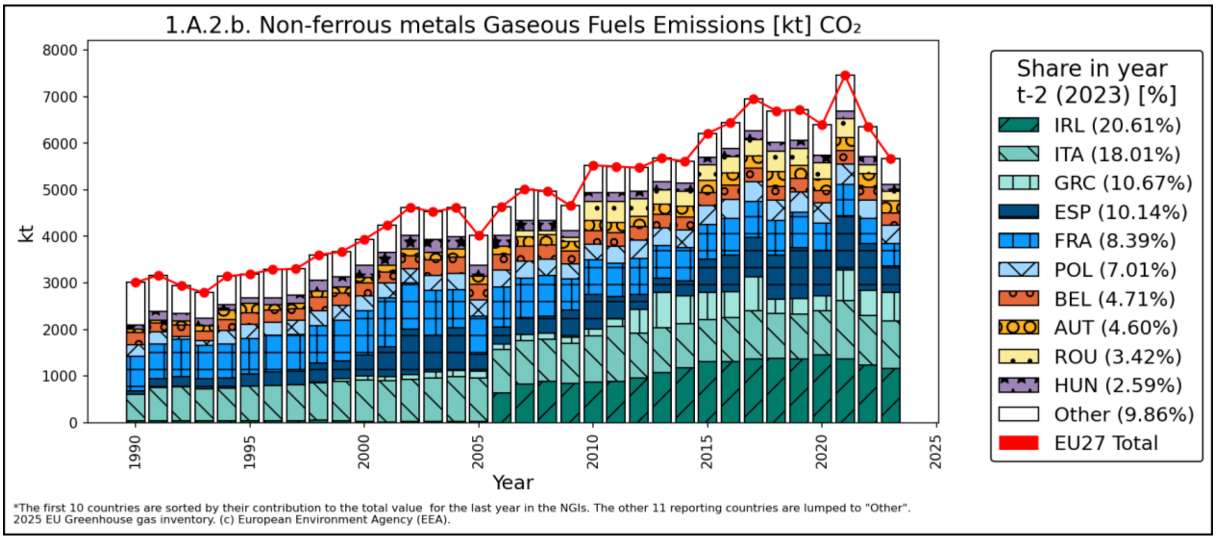
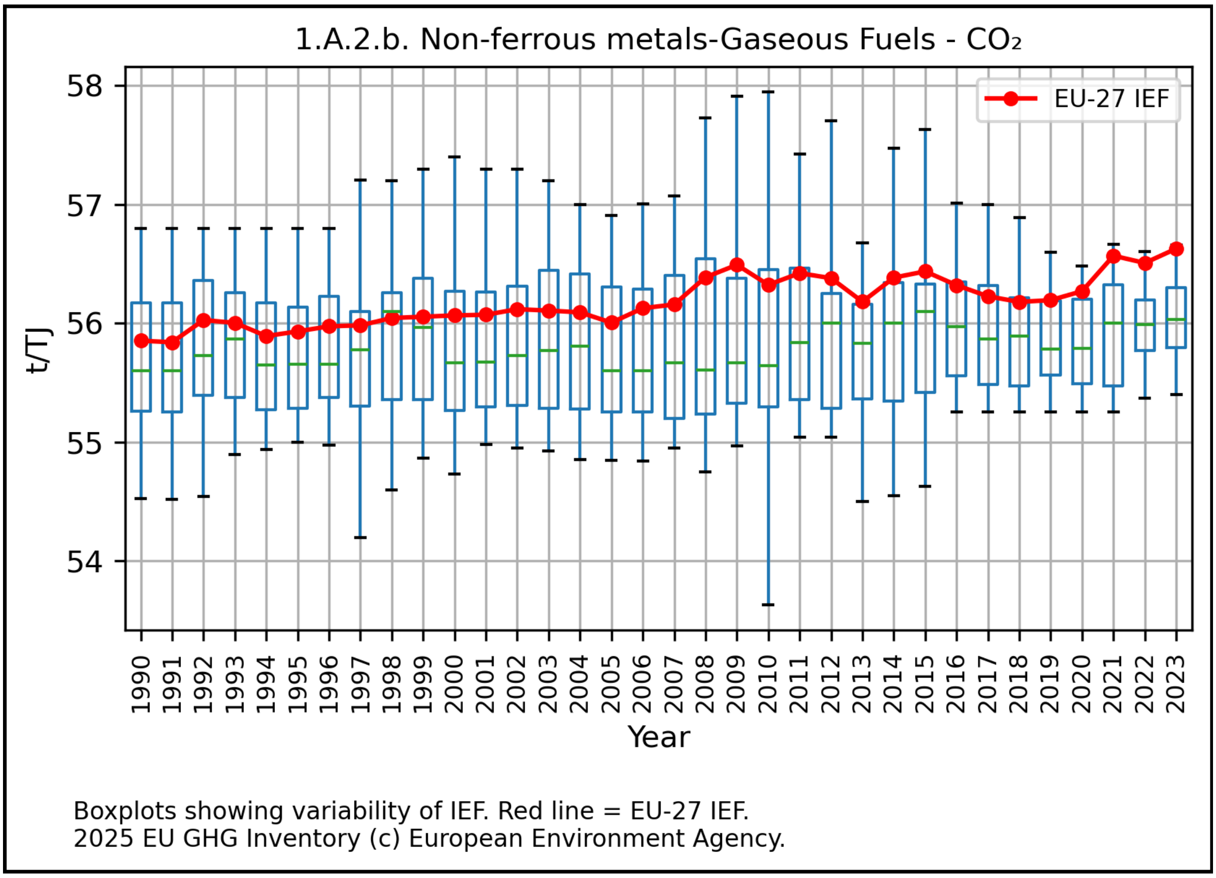


Figure 3.50 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF equalled to 56.65 t/TJ in 2023.

Figure 3.50: 1.A.2.b Non-ferrous Metals, Gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



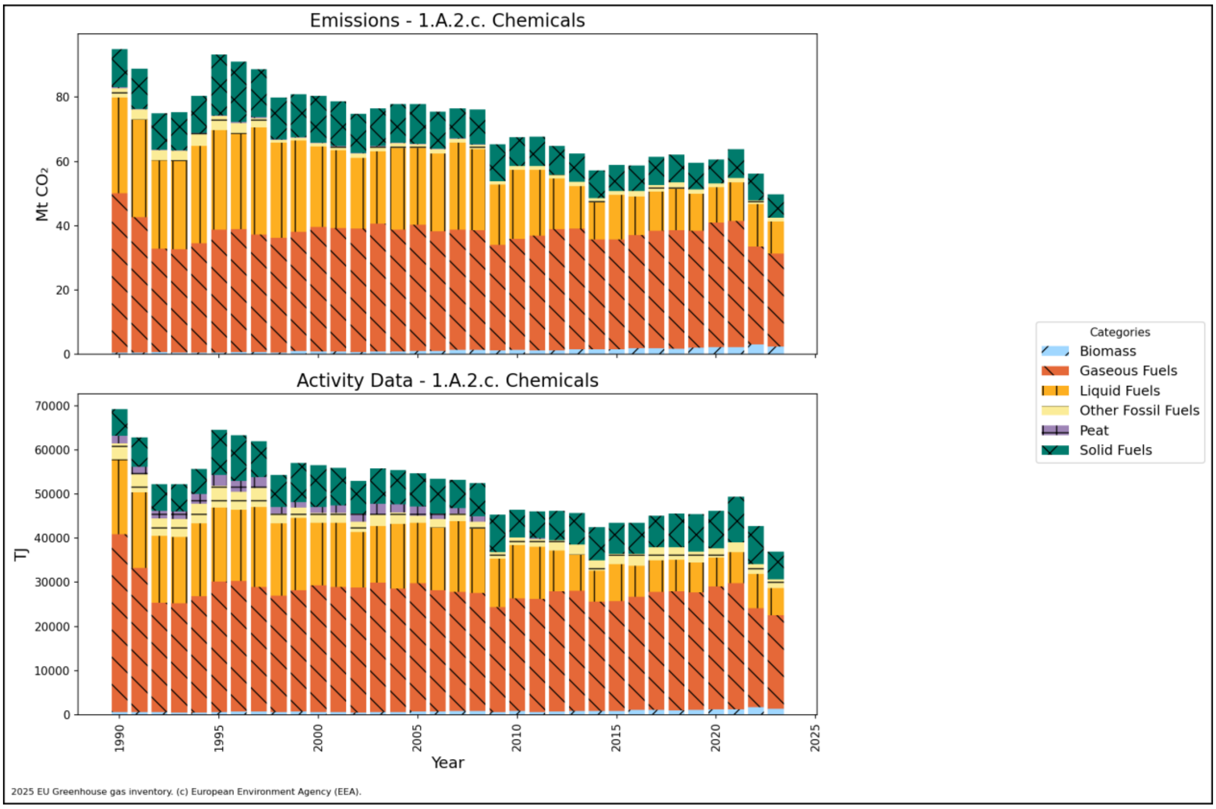
3.6.2.3 Chemicals (1.A.2.c)

This chapter provides information about European emission trend contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.c Chemicals.

Total CO_2 emissions from 1.A.2.c amounted to 47 406 kt CO_2 eq. in 2023. The trend of total CO_2 emissions for 1990 to 2023 from category 1.A.2.c is depicted in Figure 3.51. CO_2 emissions decreased by 50 % since 1990 and decreased by 11 % between 2022 and 2023. CO_2 emissions from 1.A.2.c Chemicals accounted for 13 % of 1.A.2. source category.

Figure 3.51 shows the emission trend within the category 1.A.2.c, which is dominated by CO_2 emissions from gaseous fuels in 2023. The share of liquid fuels on CO_2 emissions from 1.A.2.c decreased from 32 % in 1990 to 21 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.c slightly increased from 13 % in 1990 to 15 % in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2.c increased from 52 % in 1990 to 61 % in 2023.

Figure 3.51: 1.A.2.c Chemicals: Total emission and activity trends



Detailed data related to the EU submissions are depicted in Table 3.33.

Table 3.33: 1.A.2.c Chemicals: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	847	1 431	1 298	2.7%	451	53%	-133	-9%	NA,T2	CS,NA
Belgium	5 098	3 358	3 338	7.0%	-1 760	-35%	-21	-1%	NA,T1,T3	D,NA,PS
Bulgaria	966	1 433	1 085	2.3%	120	12%	-348	-24%	NA,T1,T2	CS,D,NA
Croatia	738	72	115	0.2%	-623	-84%	43	59%	NA,T1	D,NA
Cyprus	2	10	12	0.0%	10	437%	2	18%	NA,T1	D,NA
Czechia	2 996	3 255	2 948	6.2%	-48	-2%	-306	-9%	NA,T1,T2	CS,D,NA
Denmark	337	186	174	0.4%	-163	-48%	-12	-6%	NA,T2,T3	CS,NA
Estonia	390	13	7	0.0%	-383	-98%	-6	-47%	NA,T1,T2	CS,D,NA
Finland	1 191	703	608	1.3%	-584	-49%	-96	-14%	NA,T3	CS,NA
France	13 074	8 148	7 546	15.9%	-5 528	-42%	-603	-7%	T2,T3	CS,PS
Germany	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Greece	808	217	383	0.8%	-424	-53%	166	76%	NA,T2	CS,NA
Hungary	1 626	339	378	0.8%	-1 249	-77%	38	11%	NA,T1,T2,T3	CS,D,NA,PS
Ireland	410	345	330	0.7%	-80	-19%	-14	-4%	NA,T2	CS,NA
Italy	21 429	10 086	8 076	17.0%	-13 353	-62%	-2 009	-20%	NA,T2	CS,NA
Latvia	294	24	22	0.0%	-271	-92%	-2	-8%	NA,T2	CS,NA
Lithuania	397	241	209	0.4%	-188	-47%	-32	-13%	NA,T2	CS,NA
Luxembourg	170	110	87	0.2%	-82	-49%	-22	-20%	NA,T1,T3	CS,D,NA
Malta	NO	6	5	0.0%	5	∞	-1	-21%	NA,T1	D,NA
Netherlands	11 574	5 966	5 803	12.2%	-5 771	-50%	-163	-3%	NA,T2	CS,D,NA
Poland	4 003	5 781	5 018	10.6%	1 015	25%	-763	-13%	NA,T1,T2	CS,D,NA
Portugal	1 412	1 121	648	1.4%	-765	-54%	-473	-42%	NA,T1,T3	D,NA,PS
Romania	17 833	1 738	1 421	3.0%	-16 413	-92%	-317	-18%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	2 652	450	398	0.8%	-2 253	-85%	-51	-11%	NA,T2	CS,NA
Slovenia	211	74	69	0.1%	-141	-67%	-4	-6%	NA,T1,T2	CS,D,NA
Spain	5 227	7 677	7 030	14.8%	1 803	34%	-647	-8%	NA,T1,T2	CS,D,NA,PS
Sweden	683	311	397	0.8%	-286	-42%	86	28%	T2	CS
EU-27	**94 367**	**53 093**	**47 406**	**100%**	**-46 961**	**-50%**	**-5 688**	**-11%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Emissions of Germany are included in 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.c Chemicals - Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.c amounted 9 981 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 66 % and compared to 2022 decreased by 24 %. Category has 3 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 60 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.34.

Table 3.34: 1.A.2.c Chemicals, Liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	97	48	41	0.4%	-56	-57%	-6	-13%	T2	CS
Belgium	1 852	173	227	2.3%	-1 624	-88%	55	32%	T1	D
Bulgaria	855	1 037	631	6.3%	-224	-26%	-406	-39%	T1	D
Croatia	291	6	9	0.1%	-283	-97%	3	47%	T1	D
Cyprus	2	10	12	0.1%	10	437%	2	18%	T1	D
Czechia	175	379	267	2.7%	91	52%	-112	-30%	T1	D
Denmark	220	31	22	0.2%	-198	-90%	-9	-28%	T2	CS
Estonia	229	6	0	0.0%	-228	-100%	-5	-97%	T1,T2	CS,D
Finland	677	603	486	4.9%	-191	-28%	-117	-19%	T3	CS
France	4 871	1 986	2 151	21.6%	-2 719	-56%	166	8%	T2,T3	CS,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	639	87	97	1.0%	-542	-85%	10	12%	T2	CS
Hungary	431	6	12	0.1%	-420	-97%	6	100%	T1	D
Ireland	131	26	28	0.3%	-103	-79%	1	6%	T2	CS
Italy	13 126	5 650	3 720	37.3%	-9 406	-72%	-1 930	-34%	T2	CS
Latvia	270	11	12	0.1%	-258	-96%	1	9%	T2	CS
Lithuania	69	8	18	0.2%	-51	-74%	10	130%	T2	CS
Luxembourg	112	3	0	0.0%	-112	-100%	-3	-91%	T1,T3	CS,D
Malta	NO	6	5	0.0%	5	∞	-1	-21%	T1	D
Netherlands	791	124	81	0.8%	-710	-90%	-42	-34%	T2	CS,D
Poland	308	901	695	7.0%	387	126%	-206	-23%	T1,T2	CS,D
Portugal	1 373	587	226	2.3%	-1 147	-84%	-361	-61%	T1,T3	D,PS
Romania	NO	974	922	9.2%	922	∞	-52	-5%	T1,T2,T3	CS,D,PS
Slovakia	51	2	3	0.0%	-49	-95%	1	61%	T2	CS
Slovenia	32	12	15	0.1%	-17	-53%	3	28%	T1,T2	CS,D
Spain	2 729	94	14	0.1%	-2 716	-99%	-81	-85%	T1,T2	CS,D
Sweden	424	311	287	2.9%	-137	-32%	-24	-8%	T2	CS
EU-27	**29 757**	**13 078**	**9 981**	**100%**	**-19 775**	**-66%**	**-3 097**	**-24%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
From 1990 to 2023 Germany includes emissions under 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.52 shows CO_2 emissions trend as well as the share of countries with the highest contribution to the total CO_2 emissions.

Figure 3.52: 1.A.2.c Chemicals, Liquid fuels: Emission trend and share for CO_2

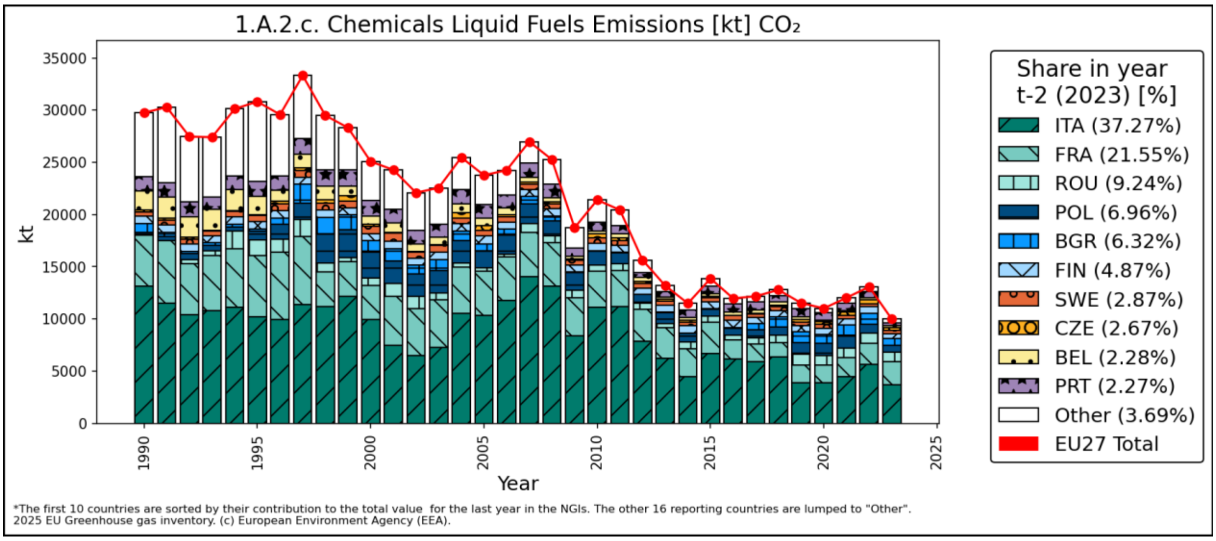
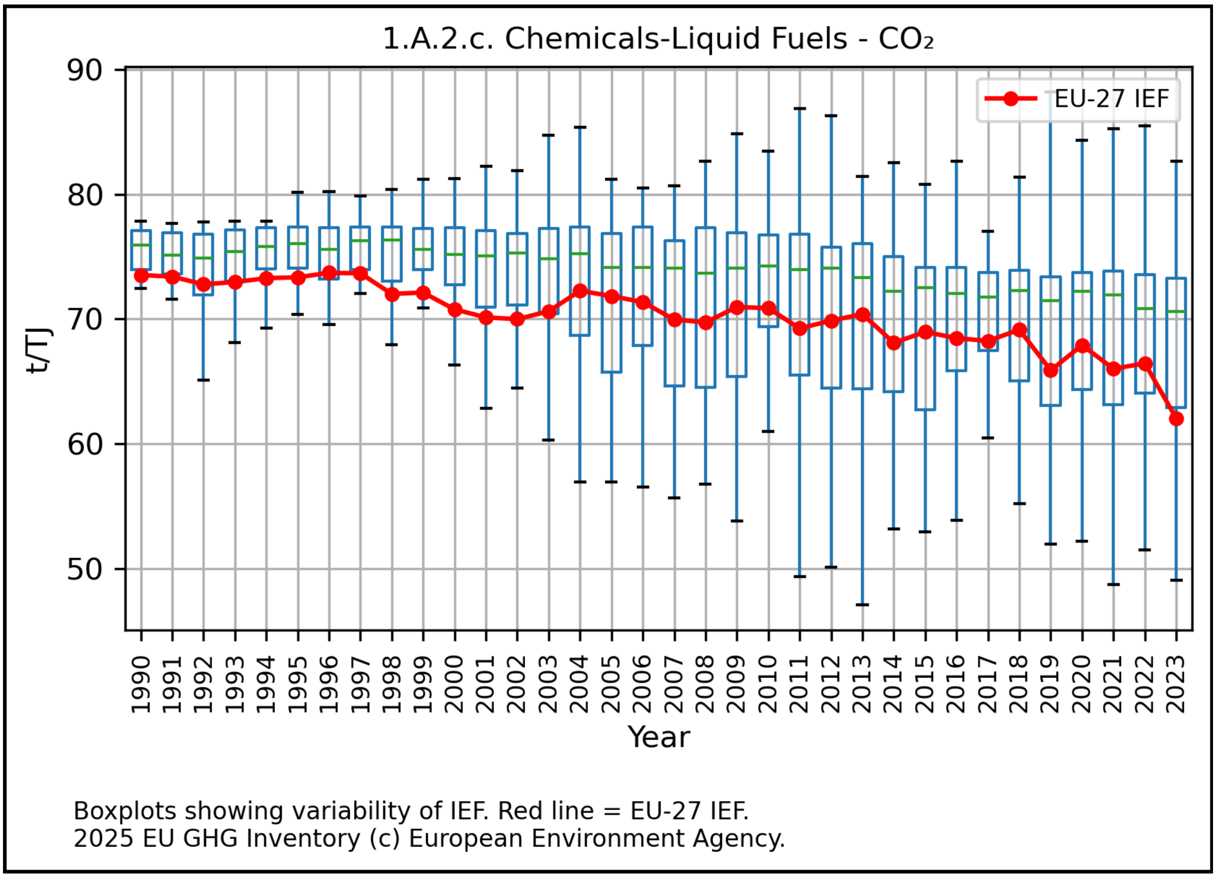


Figure 3.53 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that CO_2 IEF fluctuates over the time period with decreasing trend. CO_2 IEF equaled to 62.01 t/TJ in 2023.

Figure 3.53: 1.A.2.c Chemicals, Liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.c Chemicals - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.c amounted 7 252 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 39 % and compared to 2022 decreased by 12 %. Category has 2% share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 40 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.35.

Table 3.35: 1.A.2.c Chemicals, Solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	106	52	22	0.3%	-84	-79%	-29	-57%	T2	CS
Belgium	688	3	2	0.0%	-685	-100%	0	-10%	T1	D
Bulgaria	80	246	353	4.9%	273	340%	107	44%	T1,T2	CS,D
Croatia	101	1	0	0.0%	-101	-100%	-1	-83%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	2 487	2 156	2 151	29.7%	-336	-14%	-5	0%	T2	CS,D
Denmark	6	NO	NO	-	-6	-100%	-	-	NA	NA
Estonia	5	NO	NO	-	-5	-100%	-	-	NA	NA
Finland	214	NO	NO	-	-214	-100%	-	-	NA	NA
France	2 123	1 046	787	10.9%	-1 336	-63%	-259	-25%	T2,T3	CS,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	169	NO	NO	-	-169	-100%	-	-	NA	NA
Hungary	140	NO	NO	-	-140	-100%	-	-	NA	NA
Ireland	72	NO	NO	-	-72	-100%	-	-	NA	NA
Italy	640	NO	NO	-	-640	-100%	-	-	NA	NA
Latvia	NO	0	0	0.0%	0	∞	0	-50%	T2	CS
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	1 087	NO	NO	-	-1 087	-100%	-	-	NA	NA
Poland	1 012	4 126	3 419	47.2%	2 407	238%	-706	-17%	T1,T2	CS,D
Portugal	39	NO	NO	-	-39	-100%	-	-	NA	NA
Romania	644	NO	0	0.0%	-644	-100%	0	∞	T1,T2	CS,D
Slovakia	1 584	9	8	0.1%	-1 576	-100%	-2	-18%	T2	CS
Slovenia	1	NO	NO	-	-1	-100%	-	-	NA	NA
Spain	678	583	500	6.9%	-179	-26%	-84	-14%	T1,T2	CS,D,PS
Sweden	101	C	9	0.1%	-92	-91%	9	∞	T2	CS
EU-27	**11 978**	**8 222**	**7 252**	**100%**	**-4 726**	**-39%**	**-970**	**-12%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 and 2023 EU sums do include emission from Sweden.

Figure 3.54 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.54: 1.A.2.c Chemicals, Solid fuels: Emission trend and share for CO_2

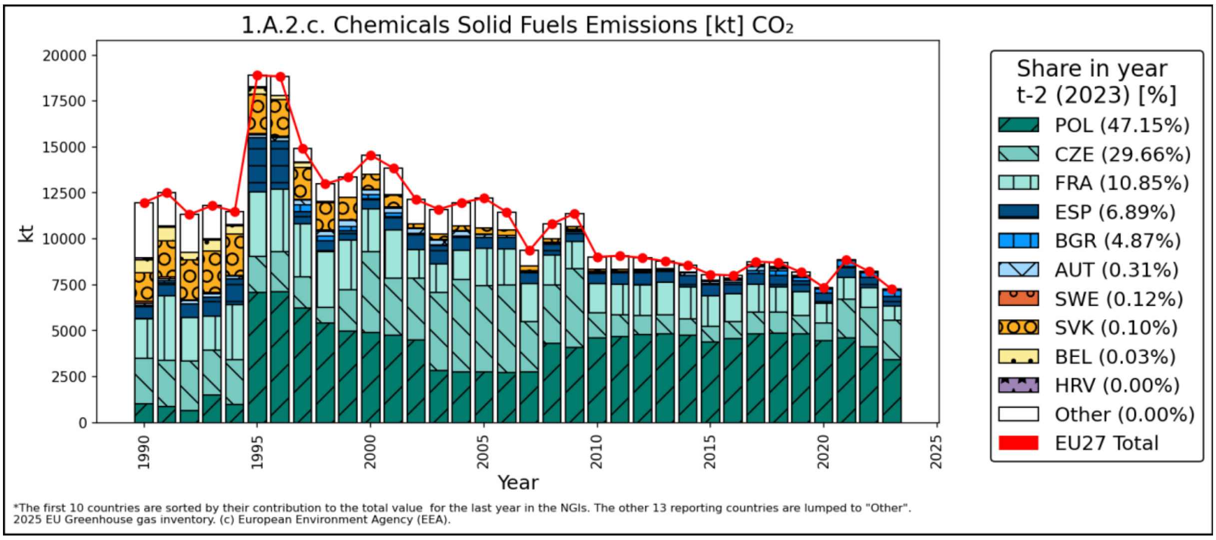
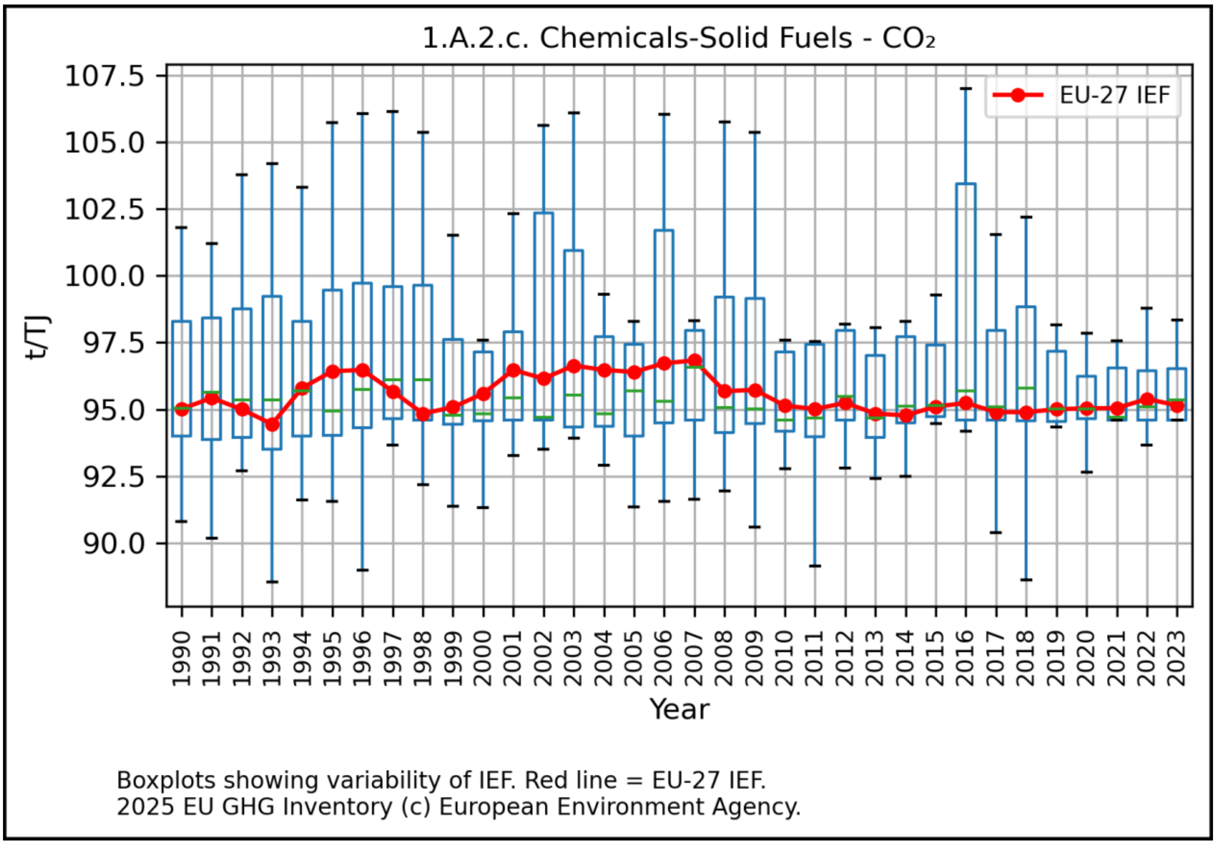


Figure 3.55 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that since 2010, the CO_2 IEF fluctuates only slightly. CO_2 IEF equalled to 95.15 t/TJ in 2023.

Figure 3.55: 1.A.2.c Chemicals, Solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.c Chemicals – Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.c amounted 28 918 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 41 % and compared to 2022 CO_2 emissions decreased by 5 %. This category represents 8 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 42 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.36.

Table 3.36: 1.A.2.c Chemicals, gaseous fuels: Member States contributions to CO_2

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	519	1 023	957	3.3%	438	84%	-67	-7%	T2	CS
Belgium	2 559	3 176	3 099	10.7%	541	21%	-77	-2%	T1,T3	D,PS
Bulgaria	30	150	101	0.3%	71	235%	-49	-33%	T2	CS
Croatia	346	66	106	0.4%	-240	-69%	41	62%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	334	719	531	1.8%	197	59%	-189	-26%	T2	CS
Denmark	110	155	152	0.5%	42	38%	-3	-2%	T3	CS
Estonia	156	7	7	0.0%	-149	-96%	-1	-8%	T2	CS
Finland	99	80	98	0.3%	0	0%	18	23%	T3	CS
France	5 611	4 194	3 723	12.9%	-1 887	-34%	-470	-11%	T2,T3	CS,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	NO	130	286	1.0%	286	∞	156	120%	T2	CS
Hungary	1 055	323	352	1.2%	-703	-67%	29	9%	T2	CS
Ireland	207	318	303	1.0%	95	46%	-16	-5%	T2	CS
Italy	7 663	4 436	4 356	15.1%	-3 307	-43%	-79	-2%	T2	CS
Latvia	24	13	10	0.0%	-13	-56%	-3	-21%	T2	CS
Lithuania	328	233	191	0.7%	-137	-42%	-42	-18%	T2	CS
Luxembourg	57	106	87	0.3%	30	52%	-19	-18%	T3	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	9 695	5 842	5 721	19.8%	-3 974	-41%	-121	-2%	T2	CS
Poland	293	720	895	3.1%	602	206%	175	24%	T2	CS
Portugal	NO	533	421	1.5%	421	∞	-112	-21%	T1,T3	D,PS
Romania	17 189	758	494	1.7%	-16 695	-97%	-264	-35%	T2,T3	CS,PS
Slovakia	989	429	377	1.3%	-612	-62%	-52	-12%	T2	CS
Slovenia	177	62	55	0.2%	-122	-69%	-7	-12%	T2	CS
Spain	1 819	6 999	6 517	22.5%	4 697	258%	-482	-7%	T2	CS
Sweden	155	C	78	0.3%	-77	-50%	78	∞	T2	CS
EU-27	**49 415**	**30 475**	**28 918**	**100%**	**-20 496**	**-41%**	**-1 557**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 and 2023 EU sums do include emission from Sweden.

Figure 3.56 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.56: 1.A.2.c Chemicals, Gaseous fuels: Emission trend and share for CO_2

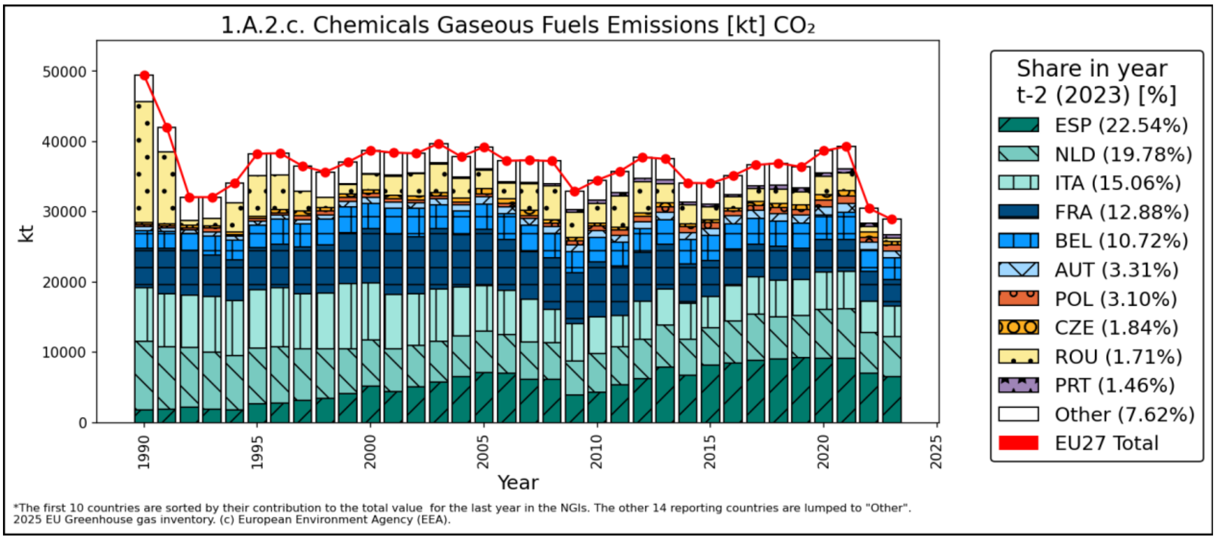
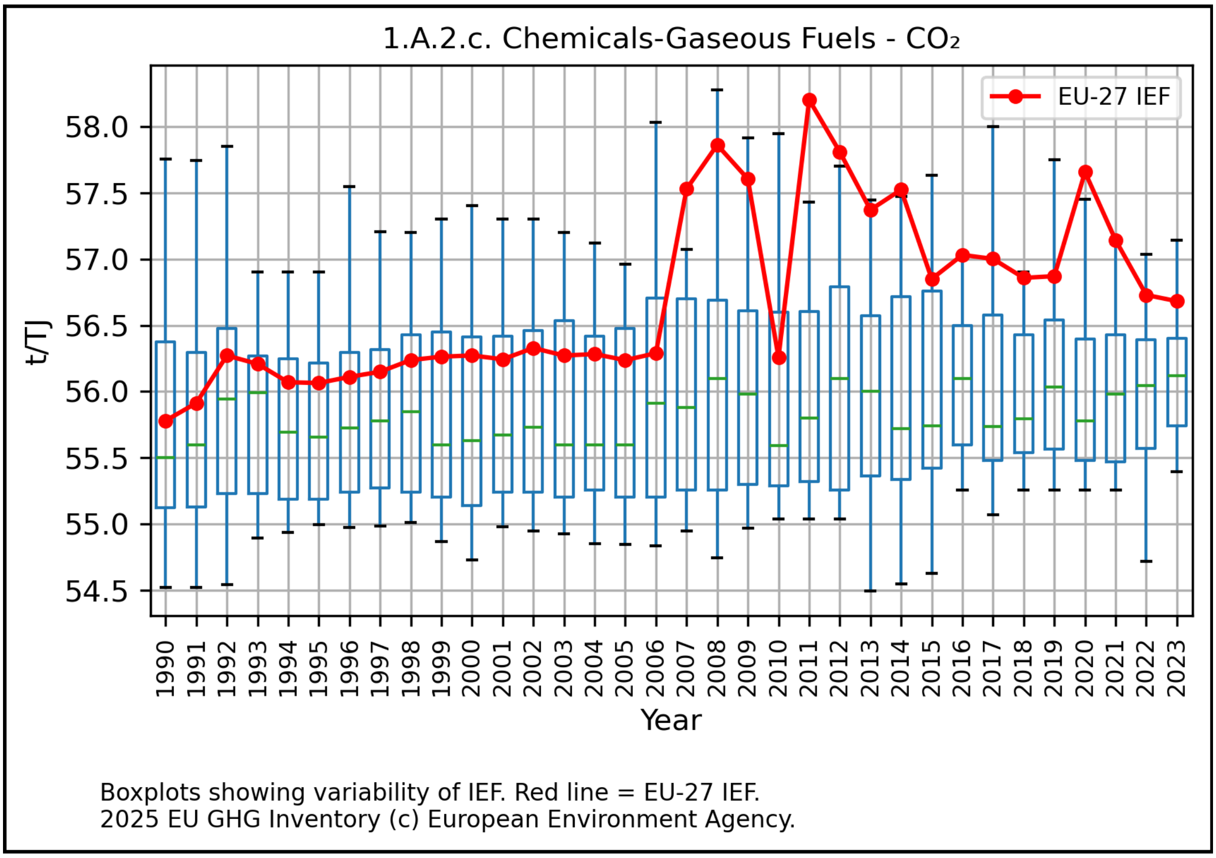


Figure 3.57 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2022. CO_2 IEF equaled to 56.68 t/TJ in 2023.

Figure 3.57: 1.A.2.c Chemicals, Gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



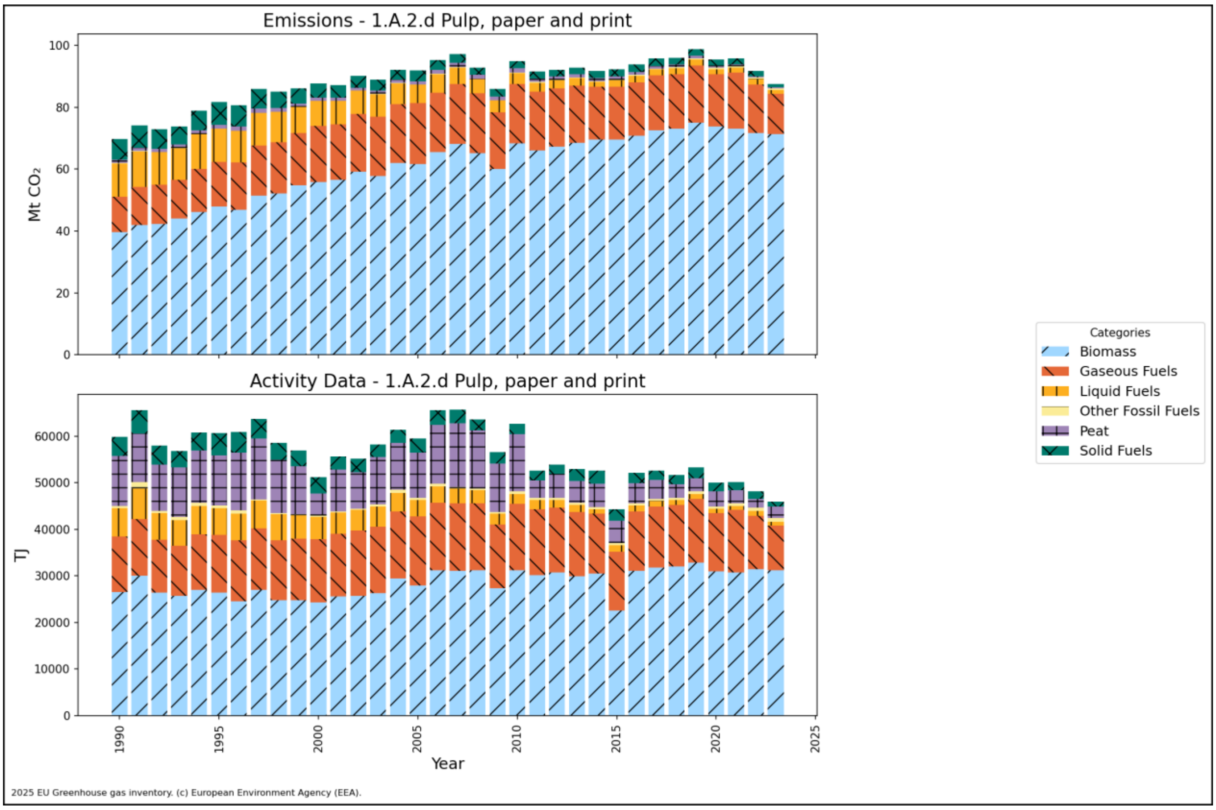
3.6.2.4 Pulp, Paper and Print (1.A.2.d)

This chapter provides information about European emission trend and Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.d Pulp, Paper and Print.

Total CO_2 emissions from 1.A.2.d amounted to 16 207 kt CO_2 eq. in 2023. The trend of total emissions for 1990 to 2023 from category 1.A.2.d is depicted in Figure 3.58. Total CO_2 emissions decreased by 46 % since 1990 and decreased by 19 % between 2022 and 2023. CO_2 emissions from 1.A.2.d Pulp, Paper and Print accounted for 4.5 % of 1.A.2. source category.

Figure 3.58 shows the emission trend within the category 1.A.2.d, which is dominated by CO_2 emissions from gaseous fuels in 2023. The share of liquid fuels on CO_2 emissions from 1.A.2.d decreased from 36 % in 1990 to 8% in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.d decreased from 22 % in 1990 to 6% in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2.d increased from 38 % in 1990 to 80 % in 2023. This sector includes a high amount of biomass consumption which is also gradually increasing since 1990. The activity data shows a strong switch from liquid and solid fuels to gaseous fuels and biomass.

Figure 3.58: 1.A.2.d Pulp, Paper and Print: Total emission and activity trends



Detailed data related to the EU submissions are depicted in Table 3.37.

Table 3.37: 1.A.2.d Pulp, Paper and Print: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	2 208	1 541	1 208	7.5%	-1 000	-45%	-334	-22%	NA,T2	CS,NA
Belgium	644	564	525	3.2%	-119	-19%	-40	-7%	NA,T1,T3	D,NA,PS
Bulgaria	16	88	58	0.4%	42	270%	-30	-35%	NA,T1,T2	CS,D,NA
Croatia	303	118	114	0.7%	-189	-62%	-4	-4%	NA,T1	D,NA
Cyprus	5	2	2	0.0%	-3	-59%	0	20%	NA,T1	D,NA
Czechia	2 285	665	508	3.1%	-1 777	-78%	-157	-24%	NA,T1,T2	CS,D,NA
Denmark	343	26	27	0.2%	-316	-92%	1	4%	NA,T2,T3	CS,NA
Estonia	145	42	25	0.2%	-120	-83%	-17	-40%	NA,T1,T2	CS,D,NA
Finland	5 330	1 874	1 302	8.0%	-4 027	-76%	-571	-30%	T3	CS
France	4 471	2 160	1 975	12.2%	-2 495	-56%	-184	-9%	T2,T3	CS,D,OTH,PS
Germany	4	9	10	0.1%	7	188%	2	18%	CS,NA	CS,NA
Greece	306	84	98	0.6%	-208	-68%	15	17%	NA,T2	CS,NA
Hungary	349	388	370	2.3%	21	6%	-18	-5%	NA,T1,T2,T3	CS,D,NA,PS
Ireland	28	16	15	0.1%	-13	-46%	-1	-4%	NA,T2	CS,NA
Italy	3 108	4 535	3 949	24.4%	841	27%	-587	-13%	NA,T2	CS,NA
Latvia	168	4	5	0.0%	-163	-97%	1	33%	NA,T2	CS,NA
Lithuania	255	28	24	0.1%	-232	-91%	-5	-16%	NA,T2	CS,NA
Luxembourg	IE,NO	8	8	0.0%	8	∞	0	-4%	NA,T2	CS,NA
Malta	NO	1	1	0.0%	1	∞	0	1%	NA,T1	D,NA
Netherlands	1 668	855	645	4.0%	-1 023	-61%	-210	-25%	NA,T2	CS,NA
Poland	284	1 359	1 205	7.4%	921	324%	-154	-11%	NA,T1,T2	CS,D,NA
Portugal	754	969	799	4.9%	45	6%	-171	-18%	NA,T1	D,NA
Romania	NO	309	188	1.2%	188	∞	-121	-39%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	2 329	244	177	1.1%	-2 152	-92%	-66	-27%	NA,T2	CS,NA
Slovenia	381	243	199	1.2%	-181	-48%	-44	-18%	NA,T1,T2,T3	CS,D,NA,PS
Spain	2 567	3 344	2 747	17.0%	180	7%	-596	-18%	NA,T1,T2,T3	CS,D,NA,PS
Sweden	2 156	641	22	0.1%	-2 134	-99%	-619	-97%	T2	CS
EU-27	**30 108**	**20 117**	**16 207**	**100%**	**-13 900**	**-46%**	**-3 910**	**-19%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Emissions of Luxembourg from 1990 to 1999 are included in 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.d Pulp, Paper and Print – Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.d amounted 1 340 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 88 % and compared to 2022 decreased by 25 %. Category has 0.4 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 88% compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.38.

Table 3.38: 1.A.2.d Pulp, Paper and Print, Liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	853	24	39	2.9%	-814	-95%	15	65%	T2	CS
Belgium	235	10	15	1.1%	-220	-94%	4	43%	T1,T3	D,PS
Bulgaria	16	1	1	0.1%	-14	-93%	0	-7%	T1	D
Croatia	58	3	3	0.2%	-55	-95%	0	-1%	T1	D
Cyprus	5	2	2	0.1%	-3	-59%	0	20%	T1	D
Czechia	461	16	18	1.3%	-443	-96%	2	10%	T1	CS,D
Denmark	94	12	13	1.0%	-81	-86%	1	10%	T2	CS
Estonia	145	2	3	0.2%	-142	-98%	1	47%	T1,T2	CS,D
Finland	1 138	456	414	30.9%	-724	-64%	-42	-9%	T3	CS
France	1 386	115	139	10.3%	-1 248	-90%	24	21%	T2,T3	CS,D,OTH,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	302	35	41	3.0%	-262	-87%	6	17%	T2	CS
Hungary	69	3	6	0.4%	-63	-92%	3	100%	T1	D
Ireland	28	3	3	0.3%	-25	-88%	0	2%	T2	CS
Italy	1 017	15	159	11.9%	-857	-84%	144	959%	T2	CS
Latvia	16	0	2	0.1%	-14	-88%	2	417%	T2	CS
Lithuania	69	1	1	0.0%	-68	-99%	0	-37%	T2	CS
Luxembourg	IE	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	1	1	0.1%	1	∞	0	1%	T1	D
Netherlands	2	NO	NO	-	-2	-100%	-	-	NA	NA
Poland	106	159	121	9.0%	15	14%	-38	-24%	T1,T2	CS,D
Portugal	754	167	239	17.8%	-515	-68%	72	43%	T1	D
Romania	NO	4	2	0.2%	2	∞	-1	-39%	T1,T2	CS,D
Slovakia	985	3	4	0.3%	-981	-100%	0	7%	T2	CS
Slovenia	98	9	3	0.2%	-95	-97%	-6	-69%	T1,T2	CS,D
Spain	1 214	207	112	8.4%	-1 102	-91%	-95	-46%	T1,T2,T3	CS,D,PS
Sweden	1 786	545	C	-	-1 786	-100%	-545	-100%	T2	CS
EU-27	**10 835**	**1 794**	**1 340**	**100%**	**-9 495**	**-88%**	**-454**	**-25%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Emissions of Germany are included in 1.A.2.g.
EU trends for 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 and 2022 EU sum do include emission from Sweden.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.59 shows CO_2 emissions trend as well as the share of countries with the highest contribution to the total CO_2 emissions.

Figure 3.59: 1.A.2.d Pulp, Paper and Print, Liquid fuels: Emission trend and share for CO_2

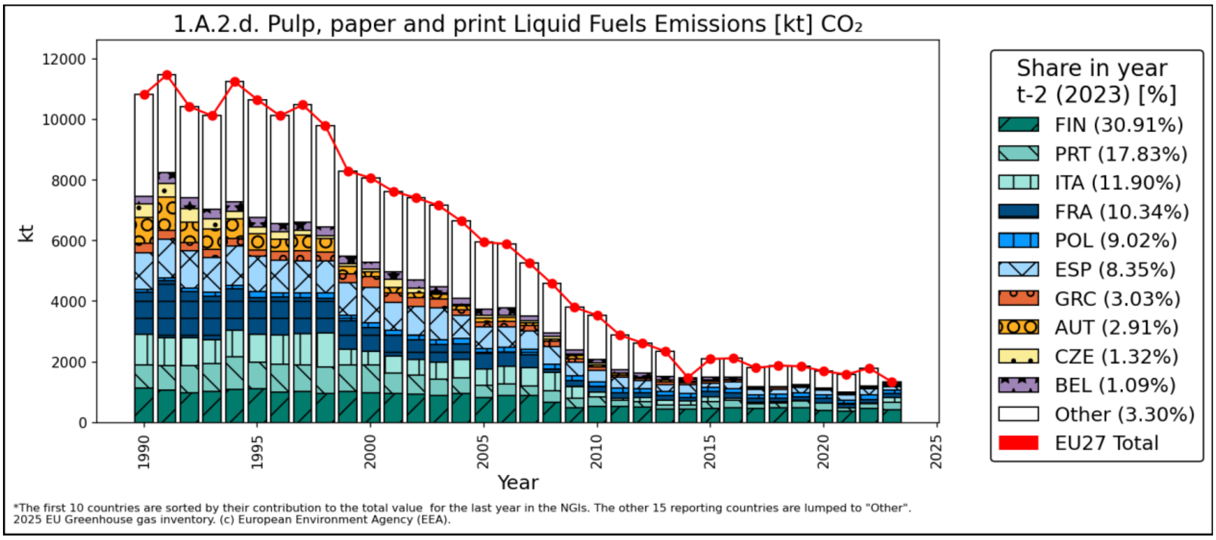
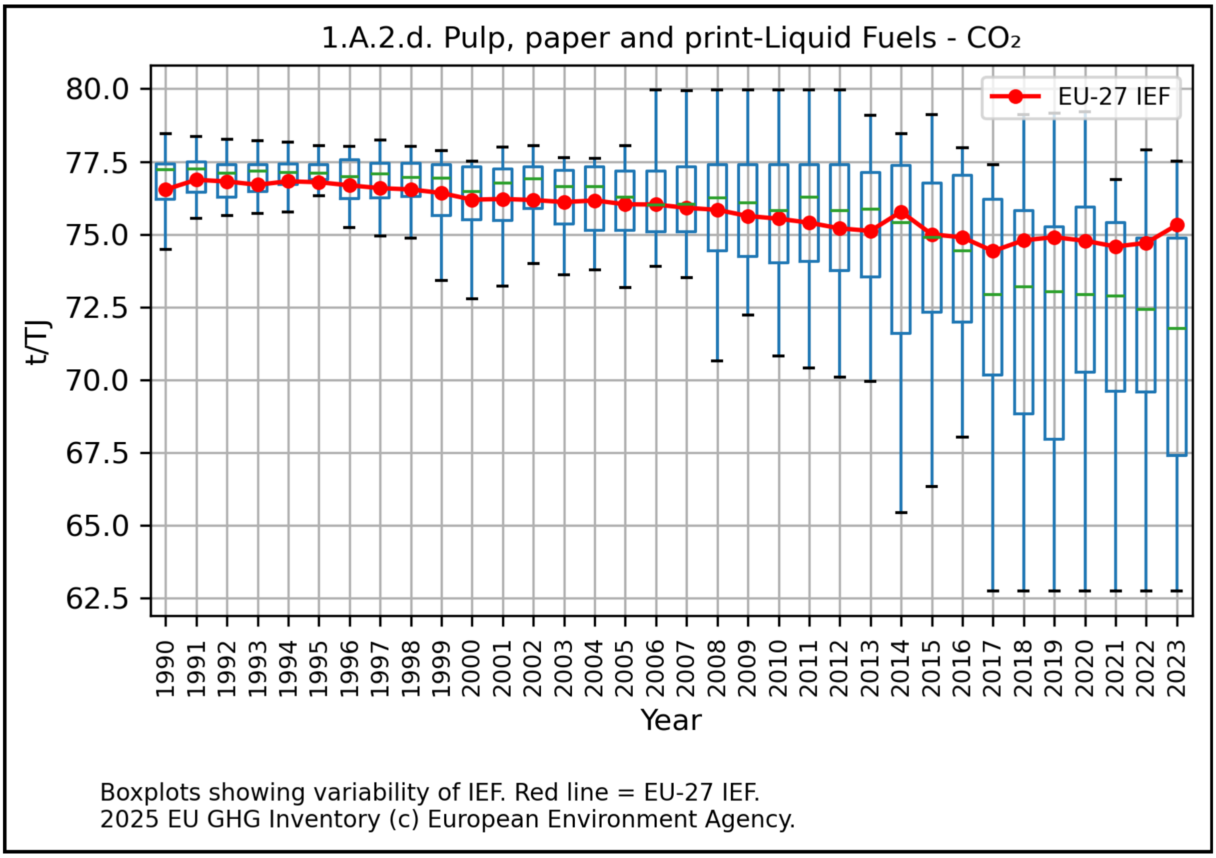


Figure.3.60 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that CO_2 IEF is decreasing during whole time period, which is caused by increasing consumption of Liquified Petroleum Gas with lower CO_2 IEF and decreasing consumption of Heavy Fuel Oil with higher CO_2 IEF. CO_2 IEF equaled to 73.39 t/TJ in 2023.

Figure.3.60: 1.A.2.d Pulp, Paper and Print, Liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.d Pulp, Paper and Print - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.d amounted 1 033 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 85 % and decreased by 40 % to 2022. This category represents 0.3 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 85 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.39.

Table 3.39: 1.A.2.d Pulp, Paper and Print, solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	398	130	49	4.8%	-349	-88%	-81	-62%	T2	CS
Belgium	128	90	75	7.2%	-53	-42%	-15	-17%	T1	D
Bulgaria	NO	12	4	0.4%	4	∞	-8	-65%	T1,T2	CS,D
Croatia	68	NO	NO	-	-68	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	1 646	367	252	24.4%	-1 393	-85%	-114	-31%	T2	CS,D
Denmark	125	NO	NO	-	-125	-100%	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 318	221	38	3.7%	-1 280	-97%	-183	-83%	T3	CS
France	1 021	NO	NO	-	-1 021	-100%	-	-	T2,T3	CS,D,OTH,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	4	NO	NO	-	-4	-100%	-	-	NA	NA
Hungary	9	156	117	11.4%	108	1222%	-39	-25%	T3	PS
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	6	NO	NO	-	-6	-100%	-	-	NA	NA
Latvia	3	NO	NO	-	-3	-100%	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	8	NO	NO	-	-8	-100%	-	-	NA	NA
Poland	173	586	432	41.8%	259	150%	-154	-26%	T1,T2	CS,D
Portugal	NO	NO	NO	-	-	-	-	-	NA	NA
Romania	NO	0	0	0.0%	0	∞	0	-19%	T1,T2	CS,D
Slovakia	1 142	87	31	3.0%	-1 110	-97%	-56	-64%	T2	CS
Slovenia	172	65	33	3.2%	-139	-81%	-31	-48%	T3	PS
Spain	277	NO	NO	-	-277	-100%	-	-	NA	NA
Sweden	265	4	NO	-	-265	-100%	-4	-100%	T2	CS
EU-27	**6 761**	**1 718**	**1 033**	**100%**	**-5 728**	**-85%**	**-685**	**-40%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Emissions of Germany are included in 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.61 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.61: 1.A.2.d Pulp, Paper and Print, Solid fuels: Emission trend and share for CO_2

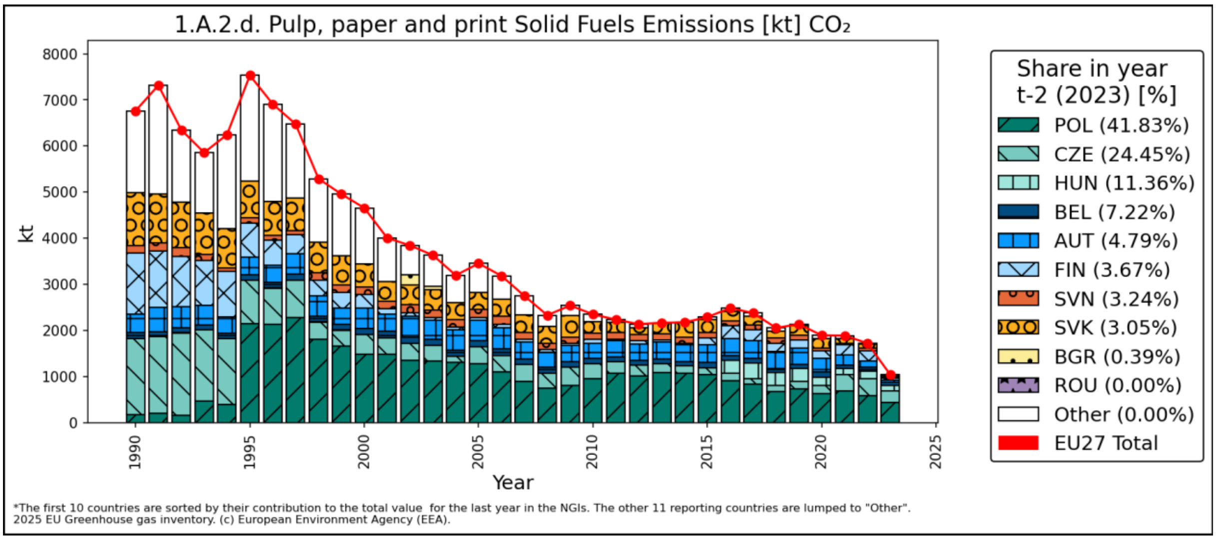
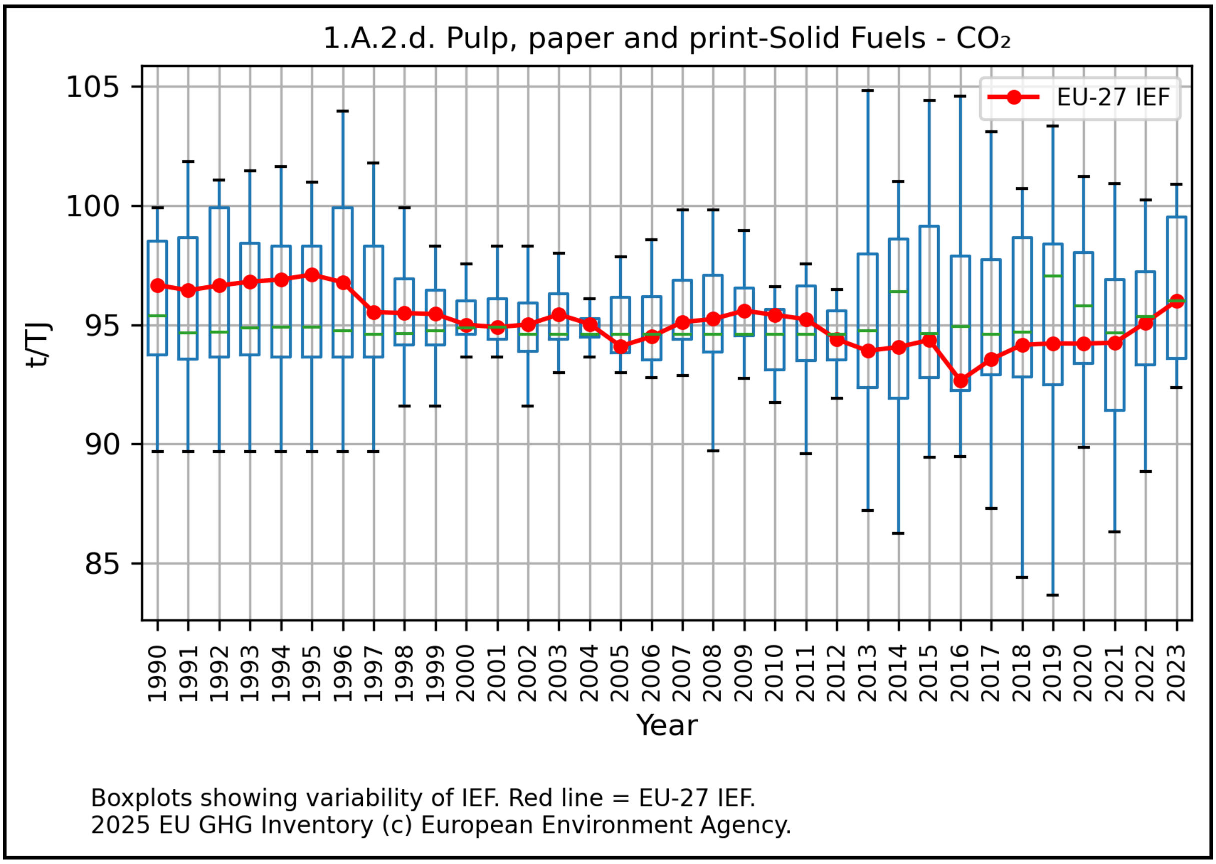


Figure 3.62 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF equaled to 95.15 t/TJ in 2023.

Figure 3.62: 1.A.2.d Pulp, Paper and Print, Solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.d Pulp, Paper and Print - Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.d amounted 13 029 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 15 % and decreased compared to 2022 by 17 %. This category has 4 % share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 13 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.40.

Table 3.40: 1.A.2.d Pulp, Paper and Print, Gaseous fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	943	1 385	1 101	8.5%	158	17%	-284	-21%	T2	CS
Belgium	282	312	292	2.2%	10	4%	-20	-6%	T1	D
Bulgaria	NO	75	52	0.4%	52	∞	-23	-30%	T2	CS
Croatia	177	115	111	0.9%	-66	-37%	-4	-4%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	179	282	238	1.8%	59	33%	-44	-16%	T2	CS
Denmark	124	14	14	0.1%	-111	-89%	0	-1%	T3	CS
Estonia	NO	40	22	0.2%	22	∞	-18	-45%	T2	CS
Finland	1 757	704	503	3.9%	-1 254	-71%	-201	-29%	T3	CS
France	2 063	2 028	1 817	13.9%	-247	-12%	-211	-10%	T2,T3	CS,D,OTH,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	NO	49	58	0.4%	58	∞	9	18%	T2	CS
Hungary	271	121	113	0.9%	-158	-58%	-8	-7%	T2	CS
Ireland	NO	13	12	0.1%	12	∞	-1	-6%	T2	CS
Italy	2 085	4 520	3 789	29.1%	1 705	82%	-731	-16%	T2	CS
Latvia	150	4	3	0.0%	-147	-98%	0	-6%	T2	CS
Lithuania	187	27	23	0.2%	-164	-88%	-4	-15%	T2	CS
Luxembourg	IE	8	8	0.1%	8	∞	0	-4%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	1 659	855	645	5.0%	-1 013	-61%	-210	-25%	T2	CS
Poland	6	528	532	4.1%	527	9444%	5	1%	T2	CS
Portugal	NO	803	560	4.3%	560	∞	-243	-30%	T1	D
Romania	NO	291	174	1.3%	174	∞	-117	-40%	T2,T3	CS,PS
Slovakia	203	153	142	1.1%	-60	-30%	-11	-7%	T2	CS
Slovenia	110	169	163	1.3%	53	48%	-6	-4%	T2	CS
Spain	1 077	3 135	2 635	20.2%	1 559	145%	-499	-16%	T2,T3	CS,PS
Sweden	66	34	22	0.2%	-44	-67%	-12	-35%	T2	CS
EU-27	**11 336**	**15 665**	**13 029**	**100%**	**1 693**	**15%**	**-2 636**	**-17%**	**-**	**-**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
Emissions of Germany are included in 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.63 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.63: 1.A.2.d Pulp, Paper and Print, Gaseous fuels: Emission trend and share for CO_2

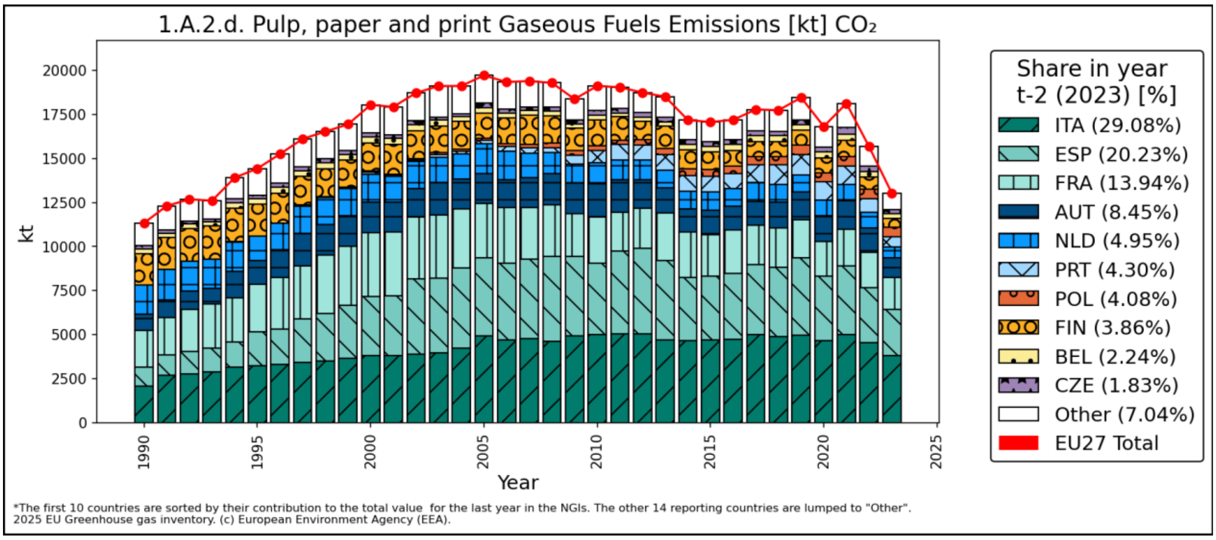
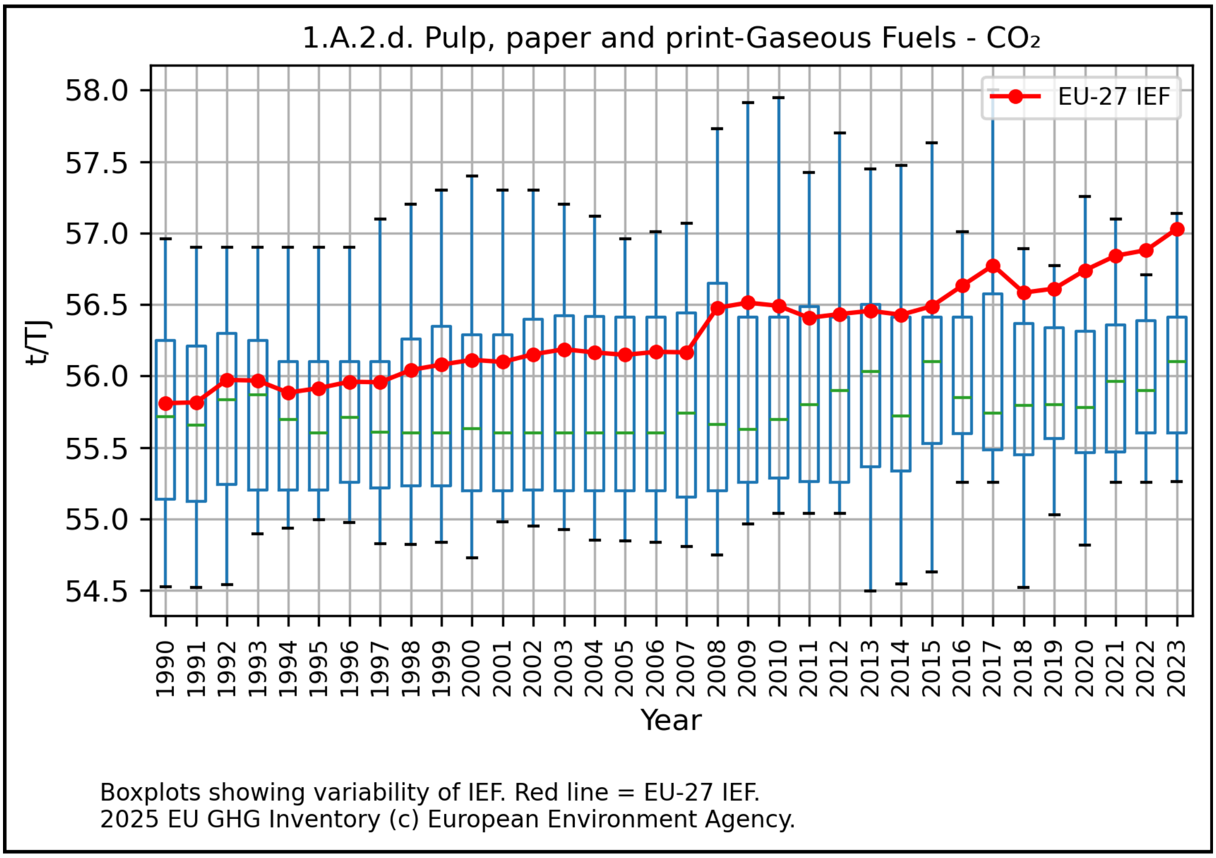


Figure 3.64 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF shows relatively stable slightly increasing trend without major fluctuations for whole time series. The main reason for increasing trend of the CO_2 IEF is the growing share of Italy and Spain on total EU emissions; their CO_2 IEFs have been slightly growing since 1990. CO_2 IEF equalled to 57.03 t/TJ in 2023.

Figure 3.64: 1.A.2.d Pulp, Paper and Print, Gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



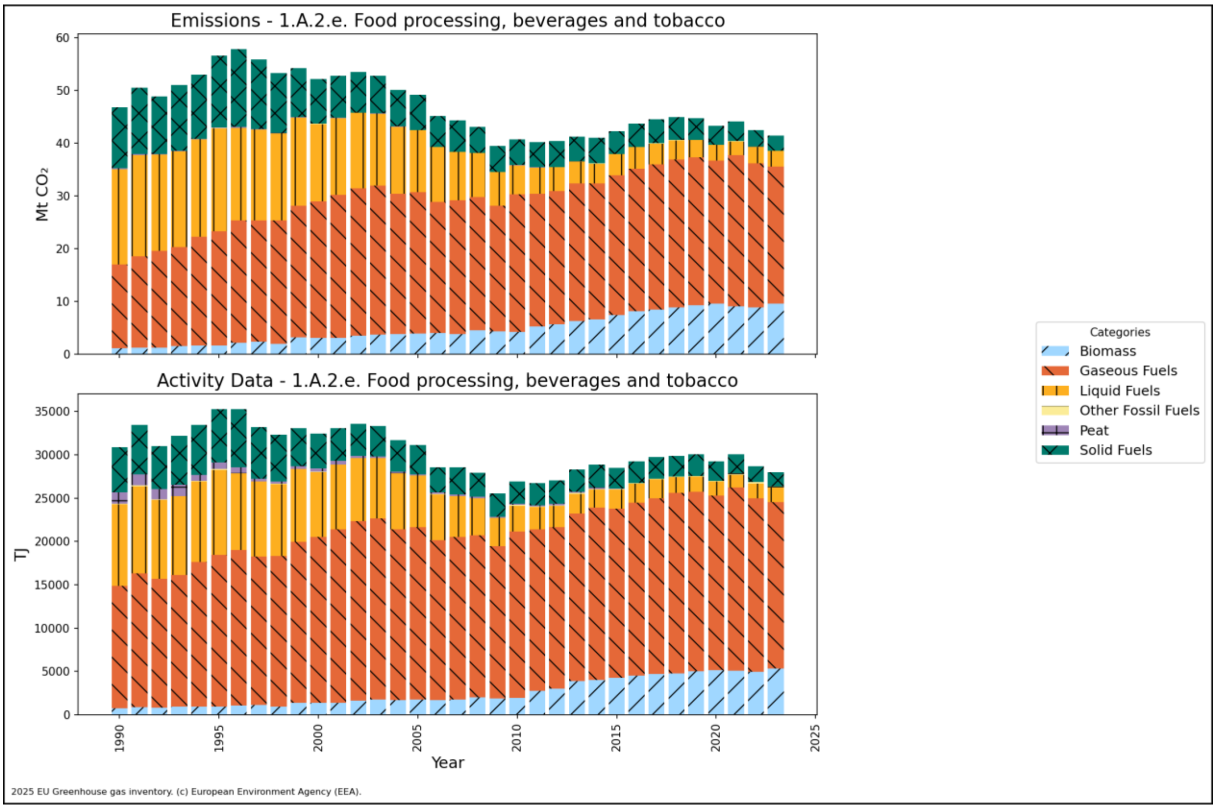
3.6.2.5 Food Processing, Beverages and Tobacco (1.A.2.e)

This chapter provides information about European emission trend, Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.e Food Processing, Beverages and Tobacco.

Total CO_2 emissions from 1.A.2.e amounted to 31 823 kt CO_2 eq. in 2023. The trend of total CO_2 emissions for 1990 to 2023 from category 1.A.2.e is depicted in Figure 3.65. Total CO_2 emissions decreased by 30 % since 1990 and decreased by 5 % between 2022 and 2023. CO_2 emissions from 1.A.2.e Food Processing, Beverages and Tobacco accounted for 9 % of 1.A.2. source category.

Figure 3.65 shows the emission trend within the category 1.A.2.e, which is dominated by CO_2 emissions from gaseous fuels in 2023. The share of liquid fuels on CO_2 emissions from 1.A.2.e decreased from 40 % in 1990 to 9 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.e decreased from 25 % in 1990 to 9 % in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2.e increased from 35 % in 1990 to 82 % in 2023.

Figure 3.65: 1.A.2.e Food Processing, Beverages and Tobacco: Total emission and activity trends



Detailed data related to the EU submissions are depicted in Table 3.41.

Table 3.41: 1.A.2.e Food Processing, Beverages and Tobacco: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	870	911	800	2.5%	-70	-8%	-111	-12%	NA,T2	CS,NA
Belgium	3 023	2 563	2 352	7.4%	-671	-22%	-211	-8%	NA,T1,T3	D,NA,PS
Bulgaria	454	303	288	0.9%	-165	-36%	-15	-5%	NA,T1,T2	CS,D,NA
Croatia	729	315	304	1.0%	-426	-58%	-11	-3%	NA,T1	D,NA
Cyprus	73	67	49	0.2%	-23	-32%	-17	-26%	NA,T1	D,NA
Czechia	2 988	1 064	948	3.0%	-2 040	-68%	-116	-11%	NA,T1,T2	CS,D,NA
Denmark	1 651	709	666	2.1%	-985	-60%	-44	-6%	NA,T1,T2,T3	CS,D,NA,PS
Estonia	695	62	46	0.1%	-649	-93%	-15	-25%	NA,T1,T2	CS,D,NA
Finland	828	97	94	0.3%	-733	-89%	-3	-3%	NA,T3	CS,NA
France	8 655	7 428	6 705	21.1%	-1 949	-23%	-722	-10%	T2,T3	CS,D,OTH,PS
Germany	2 016	205	239	0.7%	-1 777	-88%	34	16%	CS,NA	CS,NO
Greece	917	625	640	2.0%	-277	-30%	16	3%	NA,T2	CS,NA
Hungary	2 279	805	797	2.5%	-1 483	-65%	-8	-1%	NA,T1,T2	CS,D,NA
Ireland	1 017	1 079	1 040	3.3%	22	2%	-39	-4%	NA,T1,T2	CS,D,NA
Italy	3 891	3 377	3 304	10.4%	-587	-15%	-74	-2%	NA,T2	CS,NA
Latvia	840	68	89	0.3%	-751	-89%	21	31%	NA,T2	CS,NA
Lithuania	676	210	265	0.8%	-412	-61%	55	26%	NA,T2	CS,NA
Luxembourg	5	13	12	0.0%	7	130%	0	-2%	NA,T1,T2,T3	CS,D,NA
Malta	NO	11	9	0.0%	9	∞	-2	-15%	NA,T1	D,NA
Netherlands	4 009	3 313	3 171	10.0%	-838	-21%	-143	-4%	NA,T2	CS,NA
Poland	3 715	4 264	4 359	13.7%	644	17%	95	2%	NA,T1,T2	CS,D,NA
Portugal	830	648	623	2.0%	-208	-25%	-25	-4%	NA,T1	CR,D,NA
Romania	132	1 059	860	2.7%	728	553%	-200	-19%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	1 140	310	307	1.0%	-833	-73%	-3	-1%	NA,T2	CS,NA
Slovenia	221	106	92	0.3%	-129	-58%	-14	-14%	NA,T1,T2	CS,D,NA
Spain	2 977	3 662	3 662	11.5%	685	23%	0	0%	NA,T1,T2	CS,D,NA
Sweden	945	233	102	0.3%	-844	-89%	-131	-56%	T2	CS
EU-27	**45 578**	**33 505**	**31 823**	**100%**	**-13 755**	**-30%**	**-1 682**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.e Food Processing, Beverages and Tobacco - Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.e amounted 2 948 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 84 % and compared to 2022 decreased by 7 %. This category represents 0.8 % share of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 81 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.42.

Table 3.42: 1.A.2.e Food Processing, Beverages and Tobacco, liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	345	94	148	5.0%	-197	-57%	54	58%	T2	CS
Belgium	1 689	124	101	3.4%	-1 587	-94%	-22	-18%	T1	D
Bulgaria	409	29	31	1.0%	-379	-93%	1	5%	T1	D
Croatia	342	65	62	2.1%	-280	-82%	-3	-4%	T1	D
Cyprus	73	67	49	1.7%	-23	-32%	-17	-26%	T1	D
Czechia	472	29	51	1.7%	-421	-89%	23	79%	T1	CS,D
Denmark	786	226	202	6.9%	-583	-74%	-23	-10%	T2,T3	CS,PS
Estonia	695	26	19	0.6%	-677	-97%	-7	-28%	T1,T2	CS,D
Finland	365	66	41	1.4%	-324	-89%	-25	-38%	T3	CS
France	3 156	448	482	16.4%	-2 673	-85%	34	8%	T2,T3	CS,D,OTH,PS
Germany	908	20	47	1.6%	-861	-95%	27	133%	CS	CS
Greece	863	464	459	15.6%	-403	-47%	-4	-1%	T2	CS
Hungary	810	29	44	1.5%	-767	-95%	15	50%	T1	D
Ireland	433	234	231	7.8%	-202	-47%	-3	-1%	T1,T2	CS,D
Italy	1 424	19	90	3.1%	-1 333	-94%	72	384%	T2	CS
Latvia	565	10	29	1.0%	-536	-95%	18	179%	T2	CS
Lithuania	174	29	36	1.2%	-138	-79%	7	26%	T2	CS
Luxembourg	2	3	3	0.1%	2	96%	0	11%	T1,T3	CS,D
Malta	NO	11	9	0.3%	9	∞	-2	-15%	T1	D
Netherlands	165	NO	NO	-	-165	-100%	-	-	NA	NA
Poland	232	372	441	14.9%	208	89%	68	18%	T1,T2	CS,D
Portugal	829	176	131	4.5%	-698	-84%	-44	-25%	T1	CR,D
Romania	NO	114	86	2.9%	86	∞	-28	-25%	T1,T2,T3	CS,D,PS
Slovakia	359	1	15	0.5%	-344	-96%	14	1234%	T2	CS
Slovenia	146	23	25	0.8%	-121	-83%	2	10%	T1,T2	CS,D
Spain	2 227	383	115	3.9%	-2 112	-95%	-268	-70%	T1	D
Sweden	596	102	C	-	-596	-100%	-102	-100%	T2	CS
EU-27	**18 064**	**3 161**	**2 948**	**100%**	**-15 116**	**-84%**	**-214**	**-7%**	**-**	**-**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
EU trends for 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 and 2022 EU sum do include emission from Sweden.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.66 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.66: 1.A.2.e Food Processing, Beverages and Tobacco, Liquid fuels: Emission trend and share for CO_2

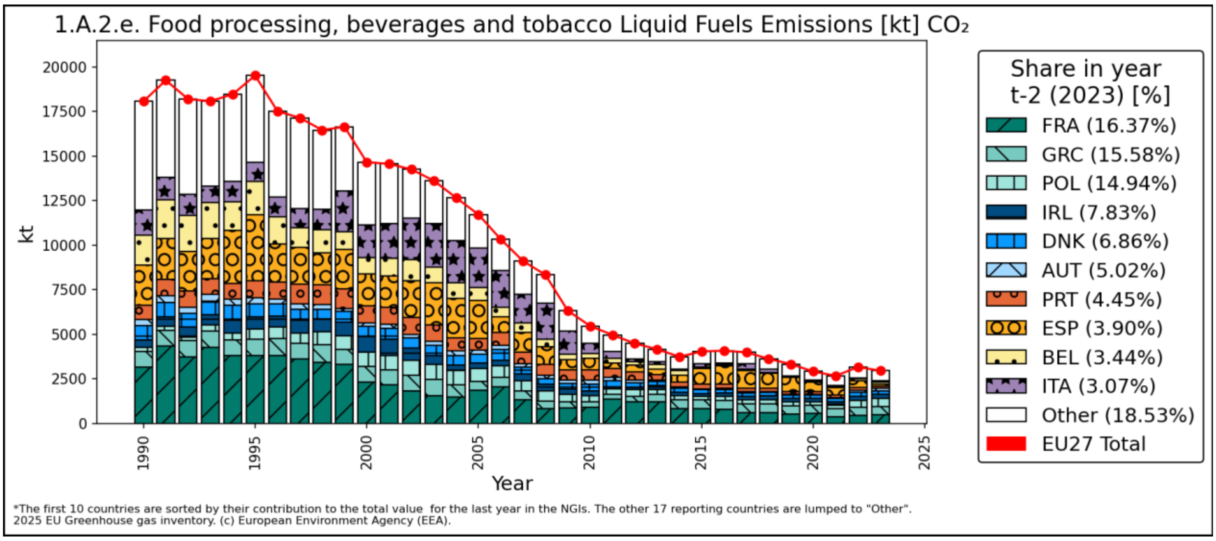
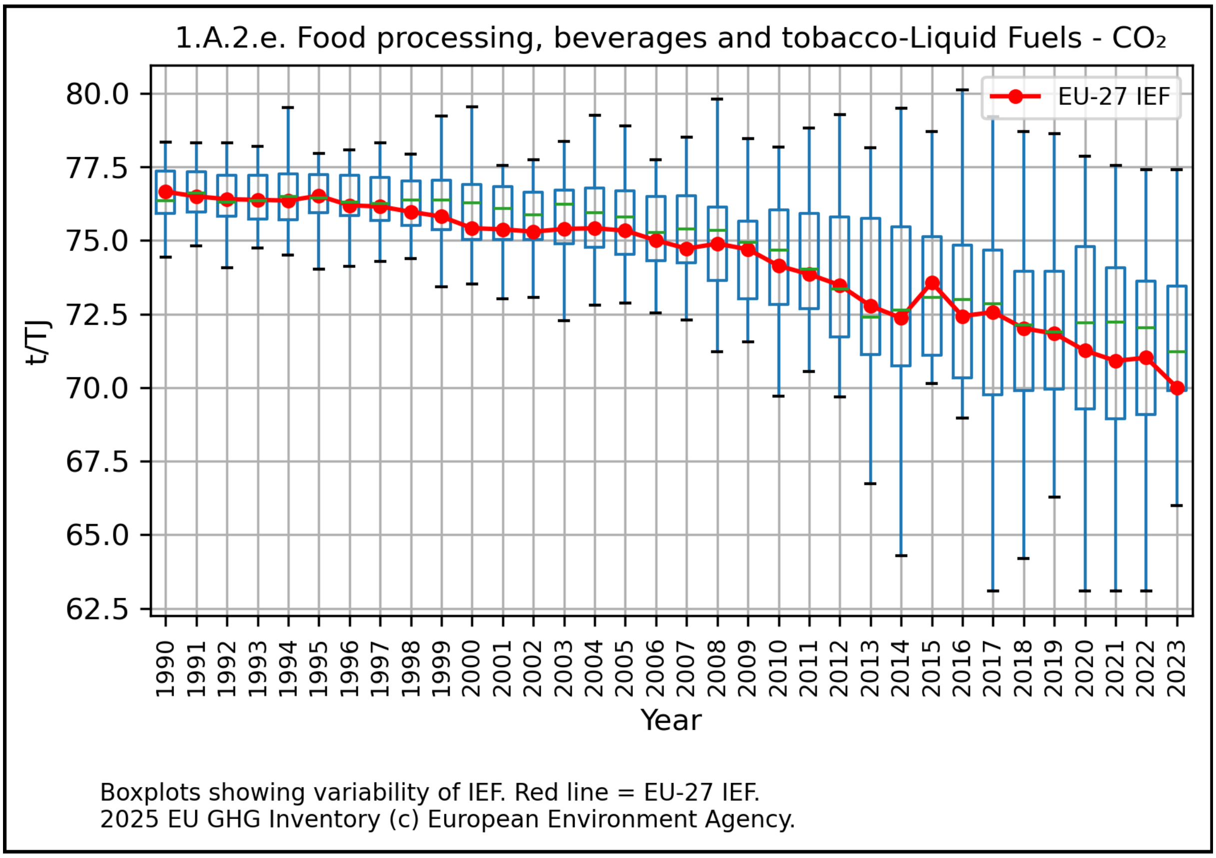


Figure 3.67 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that whole time series CO_2 IEF has decreasing trend with minor fluctuation between 2014 and 2018. CO_2 IEF equalled to 70.09 t/TJ in 2023.

Figure 3.67: 1.A.2.e Food Processing, Beverages and Tobacco, Liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.e Food Processing Beverages and Tobacco - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.e amounted 2 820 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 76 % and compared to 2022 decreased by 7 %. This category represents 0.8 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 75 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.43.

Table 3.43: 1.A.2.e Food Processing, Beverages and Tobacco, Solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	18	17	16	0.6%	-2	-11%	-1	-4%	T2	CS
Belgium	651	42	30	1.1%	-621	-95%	-12	-29%	T1	D
Bulgaria	33	5	4	0.1%	-29	-87%	-1	-23%	T1,T2	CS,D
Croatia	207	8	7	0.2%	-200	-97%	-1	-16%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	1 789	365	325	11.5%	-1 464	-82%	-40	-11%	T2	CS,D
Denmark	399	92	83	2.9%	-316	-79%	-9	-10%	T1,T2,T3	CS,D,PS
Estonia	NO	NO	0	0.0%	0	∞	0	∞	T2	CS
Finland	257	18	25	0.9%	-232	-90%	6	35%	T3	CS
France	2 053	209	166	5.9%	-1 887	-92%	-43	-21%	T2,T3	CS,D,OTH,PS
Germany	1 108	185	192	6.8%	-916	-83%	7	4%	CS	CS
Greece	54	NO	NO	-	-54	-100%	-	-	NA	NA
Hungary	241	3	6	0.2%	-234	-97%	3	103%	T1,T2	CS,D
Ireland	292	NO	NO	-	-292	-100%	-	-	NA	NA
Italy	87	NO	NO	-	-87	-100%	-	-	NA	NA
Latvia	100	1	1	0.0%	-100	-99%	0	-22%	T2	CS
Lithuania	33	6	8	0.3%	-25	-76%	2	36%	T2	CS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	227	40	35	1.2%	-192	-85%	-5	-13%	T2	CS
Poland	3 374	1 999	1 893	67.1%	-1 481	-44%	-106	-5%	T1,T2	CS,D
Portugal	1	NO	NO	-	-1	-100%	-	-	NA	NA
Romania	132	4	5	0.2%	-126	-96%	1	32%	T2,T3	CS,PS
Slovakia	312	4	4	0.1%	-308	-99%	0	-8%	T2	CS
Slovenia	9	NO	NO	-	-9	-100%	-	-	NA	NA
Spain	90	20	20	0.7%	-70	-78%	0	-1%	T1,T2	CS,D
Sweden	90	NO	NO	-	-90	-100%	-	-	T2	CS
EU-27	**11 557**	**3 019**	**2 820**	**100%**	**-8 737**	**-76%**	**-199**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.68 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.68: 1.A.2.e Food Processing, Beverages and Tobacco, solid fuels: Emission trend and share for CO_2

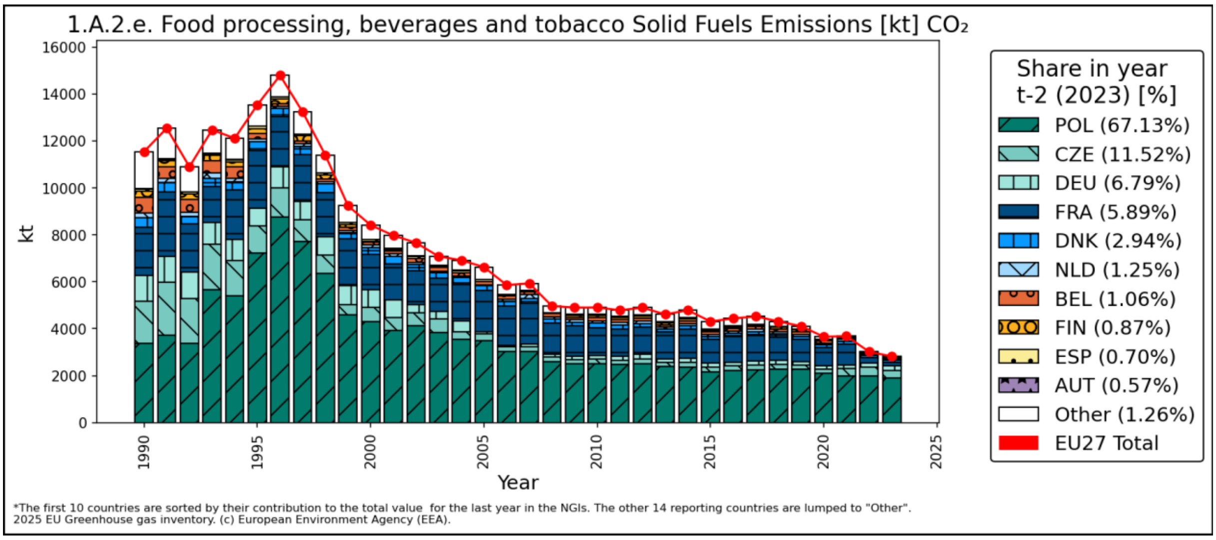
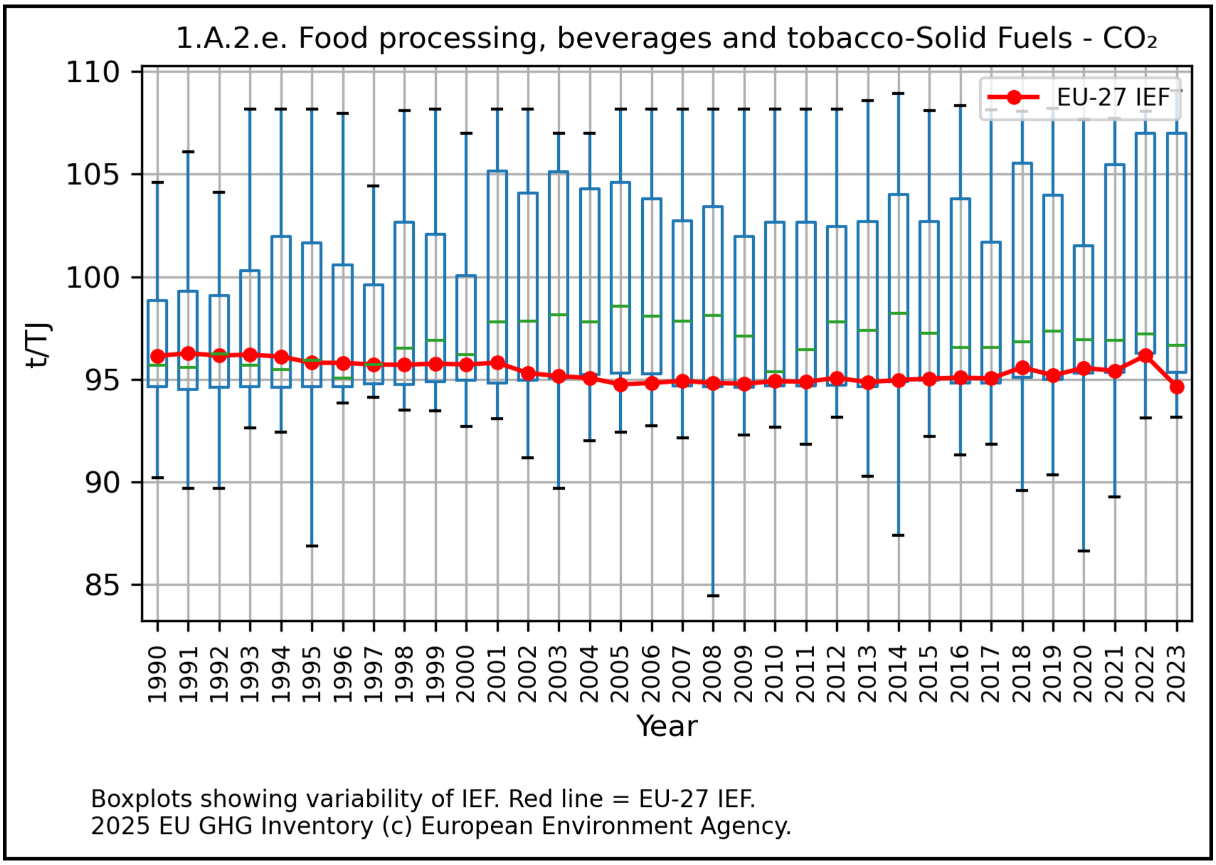


Figure 3.69 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. It can be seen that CO_2 IEF is relatively stable during whole period. CO_2 IEF equalled to 94.66 t/TJ in 2023.

Figure 3.69: 1.A.2.e Food Processing, Beverages and Tobacco, Solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.e Food Processing Beverages and Tobacco - Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.e amounted 25 992 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 64 % and decreased by 5 % compared to 2022. This category represents 7 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 64 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.44.

Table 3.44: 1.A.2.e Food Processing, Beverages and Tobacco, gaseous fuels: Member States contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	507	800	635	2.4%	129	25%	-165	-21%	T2	CS
Belgium	684	2 397	2 221	8.5%	1 537	225%	-176	-7%	T1,T3	D,PS
Bulgaria	11	268	253	1.0%	242	2118%	-15	-6%	T2	CS
Croatia	180	242	235	0.9%	54	30%	-7	-3%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	727	670	572	2.2%	-155	-21%	-98	-15%	T2	CS
Denmark	466	392	380	1.5%	-85	-18%	-11	-3%	T3	CS
Estonia	NO	36	27	0.1%	27	∞	-8	-24%	T2	CS
Finland	67	13	29	0.1%	-38	-57%	15	118%	T3	CS
France	3 446	6 730	6 030	23.2%	2 585	75%	-699	-10%	T2,T3	CS,D,OTH,PS
Germany	IE	IE	IE	-	-	-	-	-	CS	CS
Greece	NO	161	181	0.7%	181	∞	20	13%	T2	CS
Hungary	1 228	773	747	2.9%	-481	-39%	-26	-3%	T2	CS
Ireland	293	846	809	3.1%	516	176%	-37	-4%	T2	CS
Italy	2 380	3 359	3 213	12.4%	833	35%	-145	-4%	T2	CS
Latvia	175	57	60	0.2%	-115	-66%	3	5%	T2	CS
Lithuania	469	175	221	0.8%	-248	-53%	45	26%	T2	CS
Luxembourg	4	10	9	0.0%	5	144%	-1	-6%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	3 617	3 273	3 135	12.1%	-481	-13%	-137	-4%	T2	CS
Poland	109	1 893	2 025	7.8%	1 917	1758%	133	7%	T2	CS
Portugal	NO	472	491	1.9%	491	∞	19	4%	T1	D
Romania	NO	894	731	2.8%	731	∞	-163	-18%	T2,T3	CS,PS
Slovakia	470	305	289	1.1%	-181	-39%	-16	-5%	T2	CS
Slovenia	66	84	67	0.3%	1	2%	-17	-20%	T2	CS
Spain	660	3 259	3 527	13.6%	2 867	434%	268	8%	T2	CS
Sweden	254	130	102	0.4%	-152	-60%	-29	-22%	T2	CS
EU-27	**15 813**	**27 238**	**25 992**	**100%**	**10 179**	**64%**	**-1 246**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Emissions of Germany included in 1.A.2.g.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.70 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.70: 1.A.2.e Food Processing, Beverages and Tobacco, Gaseous fuels: Emission trend and share for CO_2

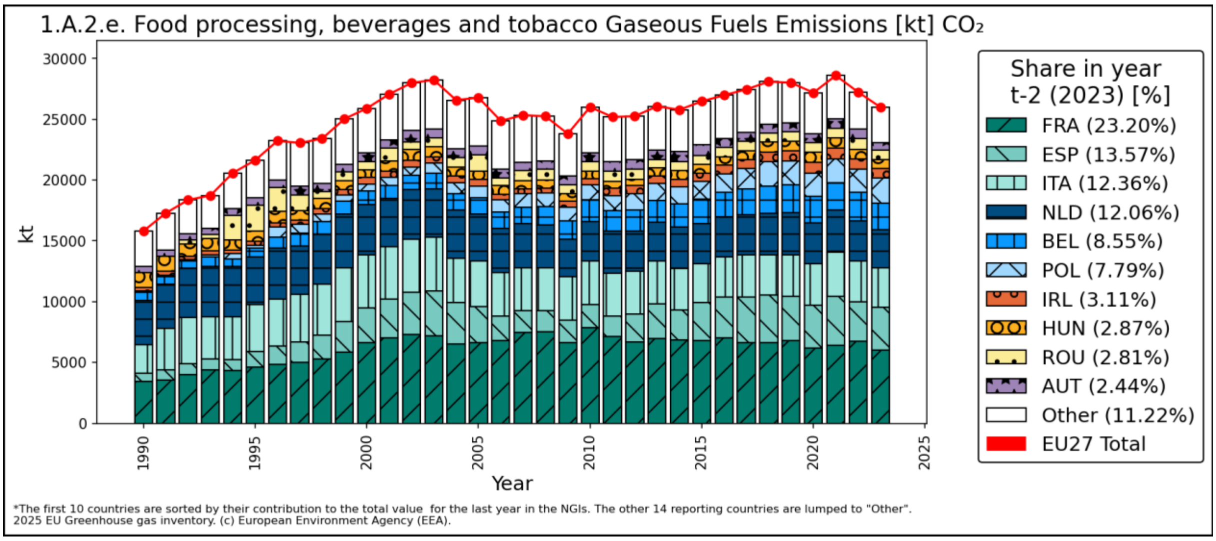
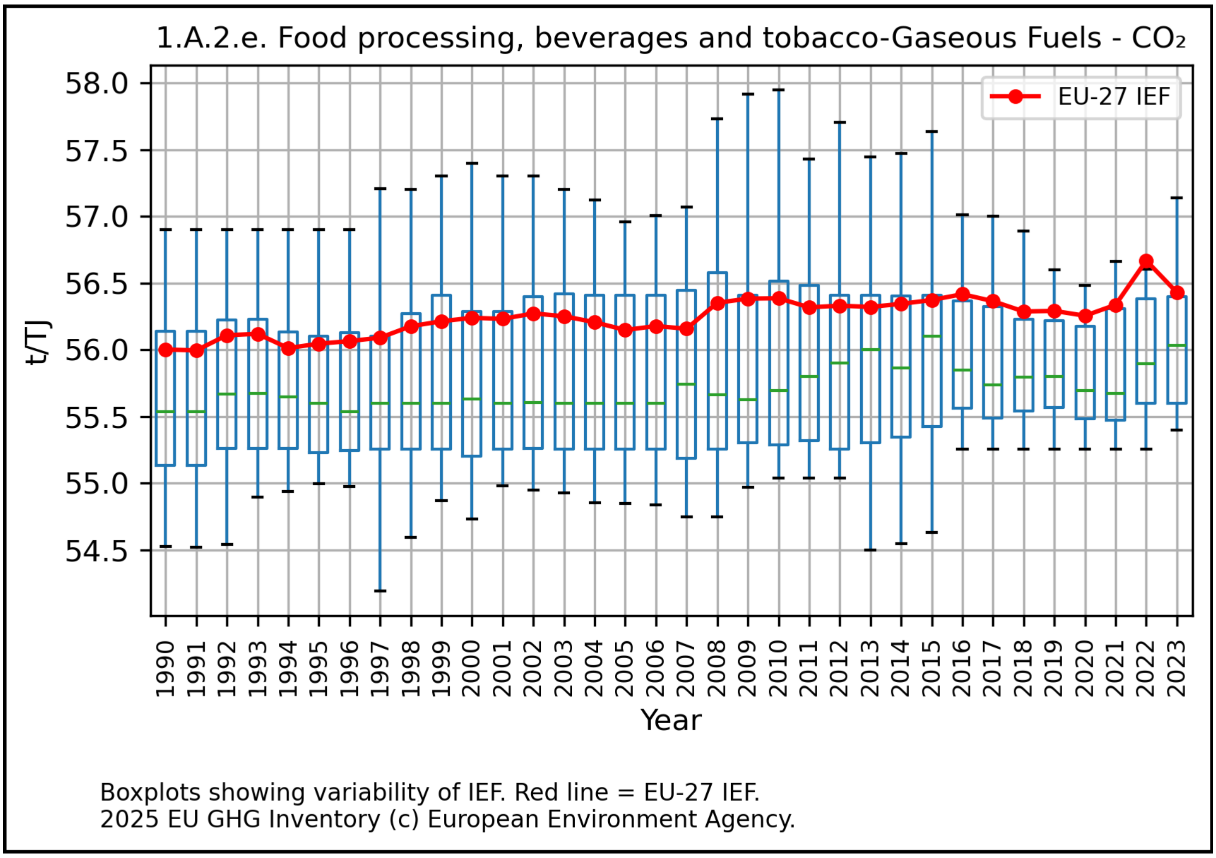


Figure 3.71 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023 which is stable with slightly increasing trend during whole time period. CO_2 IEF equalled to 56.43 t/TJ in 2023.

Figure 3.71: 1.A.2.e Food Processing, Beverages and Tobacco, Gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



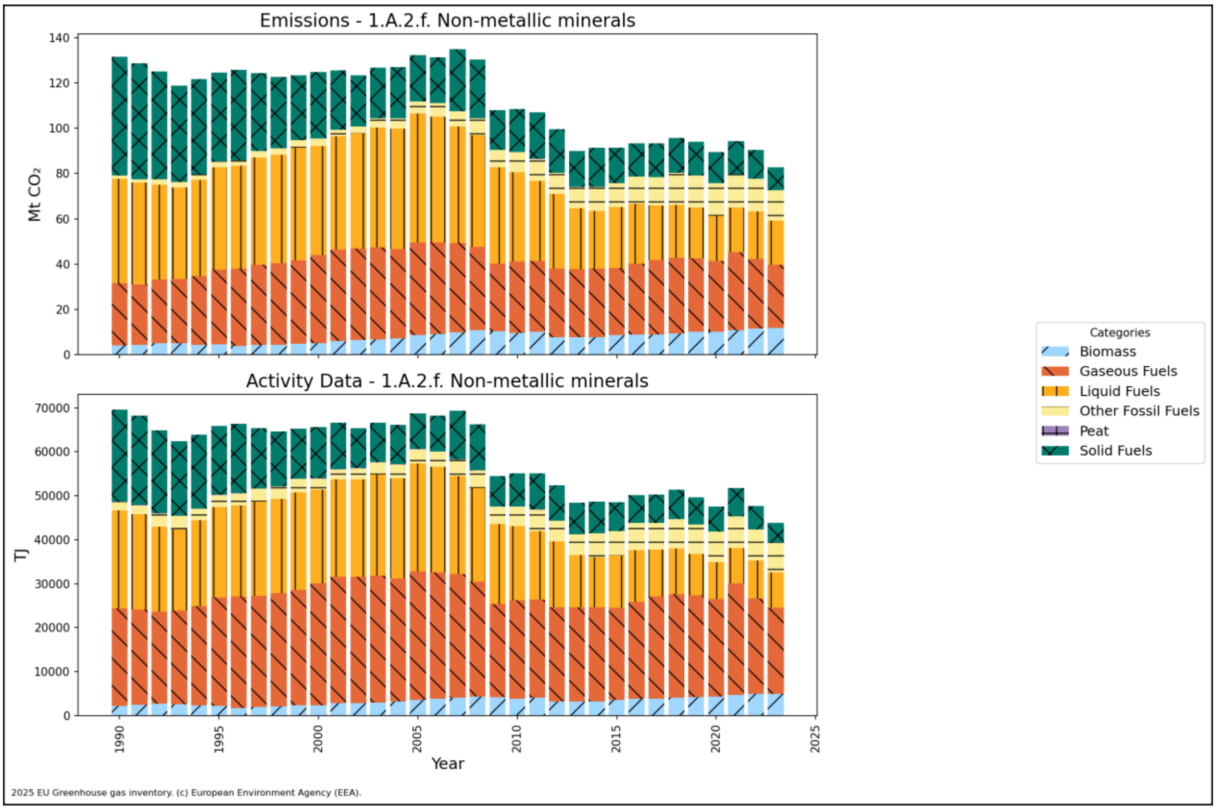
3.6.2.6 Non-metallic Minerals (1.A.2.f)

This chapter provides information about European emission trend, Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.f Non-metallic Minerals.

Total CO_2 emissions from 1.A.2.f amounted to 70 890 kt CO_2 eq. in 2023. The trend of total emissions for 1990 to 2023 from category 1.A.2.f is depicted in Figure 3.72. Total CO_2 emissions decreased by 44 % since 1990 and decreased by 10 % between 2022 and 2023. The sharp decline in 2009 is due to the economic crisis and sharp decline in building activity. CO_2 emissions from 1.A.2.f Non-metallic Minerals accounted for 20 % of 1.A.2. source category.

Figure 3.72 shows the emission trend within the category 1.A.2.f which is dominated by CO_2 emissions from gaseous fuels in 2023. The share of liquid fuels on CO_2 emissions from 1.A.2.f decreased from 36 % in 1990 to 28 % in 2023. The share of solid fuels on CO_2 emissions from 1.A.2.f decreased from 41 % in 1990 to 14 % in 2023. The share of gaseous fuels on CO_2 emissions from 1.A.2.f increased from 21 % in 1990 to 39 % in 2023.

Figure 3.72: 1.A.2.f Non-metallic Minerals: Activity data and total emission trends



Detailed data related to the EU submissions are depicted in Table.3.45.

Table.3.45: 1.A.2.f Non-metallic Minerals: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 669	1 579	1 378	1.9%	-291	-17%	-201	-13%	NA,T2	CS,NA
Belgium	5 525	2 945	2 650	3.7%	-2 875	-52%	-295	-10%	NA,T1,T3	D,NA,PS
Bulgaria	2 646	1 050	941	1.3%	-1 705	-64%	-109	-10%	NA,T1,T2	CS,D,NA
Croatia	1 924	1 313	1 357	1.9%	-567	-29%	43	3%	NA,T1	D,NA
Cyprus	380	393	404	0.6%	24	6%	11	3%	CS,NA	CS,NA
Czechia	4 527	2 435	2 164	3.1%	-2 363	-52%	-270	-11%	NA,T1,T2	CS,D,NA
Denmark	1 346	1 390	1 024	1.4%	-322	-24%	-366	-26%	NA,T2,T3	CS,NA,PS
Estonia	1 053	39	61	0.1%	-992	-94%	22	57%	T1,T2,T3	CS,D,PS
Finland	1 368	570	420	0.6%	-949	-69%	-150	-26%	NA,T3	CS,NA
France	15 050	8 845	8 170	11.5%	-6 879	-46%	-674	-8%	T1,T2,T3	CS,D,OTH,PS
Germany	18 507	12 482	10 846	15.3%	-7 662	-41%	-1 637	-13%	CS,NA	CS,NA
Greece	6 278	2 789	2 468	3.5%	-3 810	-61%	-321	-12%	NA,T2	CS,NA,PS
Hungary	2 471	916	605	0.9%	-1 866	-76%	-311	-34%	NA,T1,T2,T3	CS,D,NA,PS
Ireland	819	1 155	1 086	1.5%	267	33%	-69	-6%	NA,T1,T2,T3	CS,D,NA,PS
Italy	21 045	11 389	10 302	14.5%	-10 743	-51%	-1 087	-10%	NA,T2	CS,NA
Latvia	599	245	255	0.4%	-344	-57%	10	4%	NA,T2	CS,NA,PS
Lithuania	3 210	489	373	0.5%	-2 837	-88%	-116	-24%	NA,T2,T3	CS,NA,OTH,PS
Luxembourg	537	260	166	0.2%	-370	-69%	-93	-36%	NA,T1,T2,T3	CS,D,NA,PS
Malta	NO	20	15	0.0%	15	∞	-5	-26%	NA,T1	D,NA
Netherlands	2 298	1 152	1 007	1.4%	-1 291	-56%	-145	-13%	NA,T2	CS,NA
Poland	10 340	8 796	7 923	11.2%	-2 416	-23%	-873	-10%	NA,T1,T2	CS,D,NA
Portugal	3 289	2 468	2 415	3.4%	-874	-27%	-53	-2%	NA,NO,T1,T3	D,NA,NO,PS
Romania	285	3 336	2 820	4.0%	2 535	890%	-517	-15%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	3 408	1 310	1 103	1.6%	-2 306	-68%	-208	-16%	NA,T2	CS,NA
Slovenia	297	441	409	0.6%	112	38%	-32	-7%	NA,T1,T2,T3	CS,D,NA,PS
Spain	16 556	10 601	10 216	14.4%	-6 341	-38%	-385	-4%	NA,T1,T2	CS,D,NA,PS
Sweden	1 832	372	312	0.4%	-1 520	-83%	-60	-16%	T2	CS
EU-27	**127 259**	**78 779**	**70 890**	**100%**	**-56 369**	**-44%**	**-7 889**	**-10%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

1.A.2.f Non-metallic Minerals - Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.f amounted 19 657 kt in 2023 for EU. CO_2 emissions decreased compared to 1990 by 57 % and compared to 2022 decreased by 6 %. Category has 5.4% share on total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 61 % compared to 1990. One of the reasons for the decline is increase in the use of waste as a fuel.

Detailed data related to the EU submissions are depicted in Table 3.46.

Table 3.46: 1.A.2.f Non-metallic Minerals , liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	508	160	190	1.0%	-318	-63%	29	18%	T2	CS
Belgium	1 509	276	191	1.0%	-1 318	-87%	-85	-31%	T1,T3	D,PS
Bulgaria	666	182	288	1.5%	-379	-57%	106	58%	T1	D
Croatia	745	407	494	2.5%	-251	-34%	87	21%	T1	D
Cyprus	148	98	133	0.7%	-15	-10%	35	36%	CS	CS
Czechia	1 029	25	40	0.2%	-990	-96%	14	57%	T1	CS,D
Denmark	535	783	460	2.3%	-75	-14%	-323	-41%	T2,T3	CS,PS
Estonia	448	0	11	0.1%	-437	-98%	11	7103%	T1,T2	CS,D
Finland	437	255	205	1.0%	-232	-53%	-51	-20%	T3	CS
France	6 508	2 659	2 526	12.9%	-3 982	-61%	-133	-5%	T1,T2,T3	CS,D,OTH,PS
Germany	2 663	900	889	4.5%	-1 774	-67%	-11	-1%	CS	CS
Greece	2 914	2 286	1 958	10.0%	-956	-33%	-328	-14%	T2	PS
Hungary	463	142	98	0.5%	-365	-79%	-44	-31%	T1,T2	CS,D
Ireland	312	604	555	2.8%	243	78%	-49	-8%	T1,T2	CS,D
Italy	11 359	4 346	3 477	17.7%	-7 882	-69%	-869	-20%	T2	CS
Latvia	267	2	7	0.0%	-260	-98%	5	228%	T2	CS
Lithuania	2 750	19	19	0.1%	-2 732	-99%	0	-2%	T2	CS
Luxembourg	23	7	2	0.0%	-21	-91%	-5	-72%	T2	CS
Malta	NO	20	15	0.1%	15	∞	-5	-26%	T1	D
Netherlands	468	0	0	0.0%	-468	-100%	0	0%	T2	CS
Poland	394	346	510	2.6%	115	29%	164	47%	T1,T2	CS,D
Portugal	1 319	1 150	1 173	6.0%	-146	-11%	23	2%	T1,T3	D,PS
Romania	NO	986	1 009	5.1%	1 009	∞	23	2%	T1,T2,T3	CS,D,PS
Slovakia	1 219	226	233	1.2%	-987	-81%	6	3%	T2	CS
Slovenia	64	140	127	0.6%	64	100%	-13	-9%	T1,T2	CS,D
Spain	8 805	4 555	4 805	24.4%	-4 000	-45%	250	5%	T1,T2	CS,D
Sweden	625	263	244	1.2%	-382	-61%	-19	-7%	T2	CS
EU-27	**46 179**	**20 839**	**19 657**	**100%**	**-26 522**	**-57%**	**-1 182**	**-6%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure.3.73 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure.3.73: 1.A.2.f Non-metallic Minerals, liquid fuels: Emission trend and share for CO_2

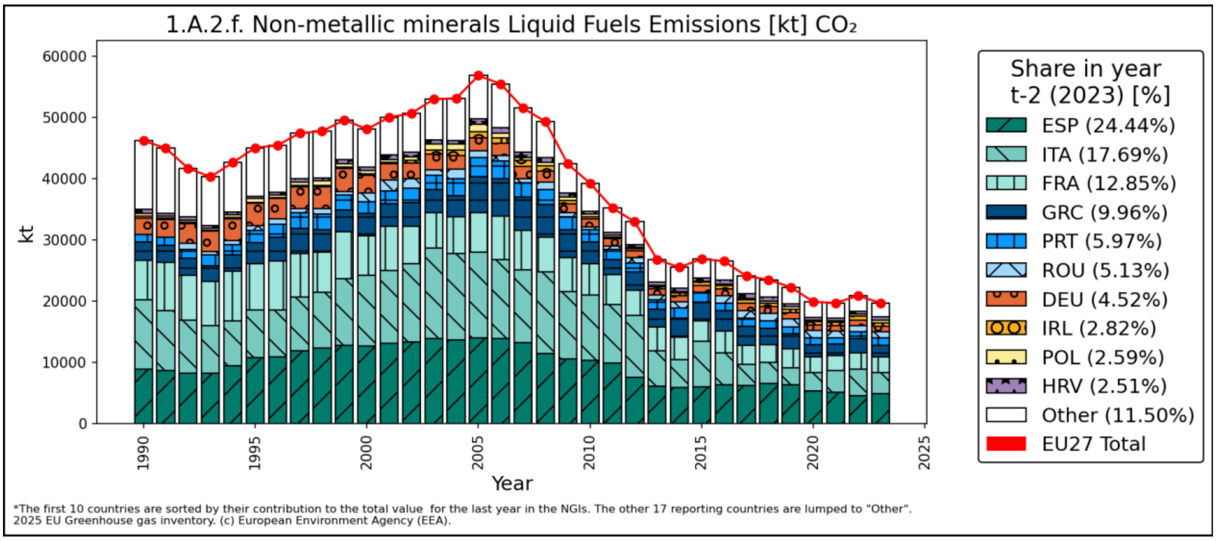
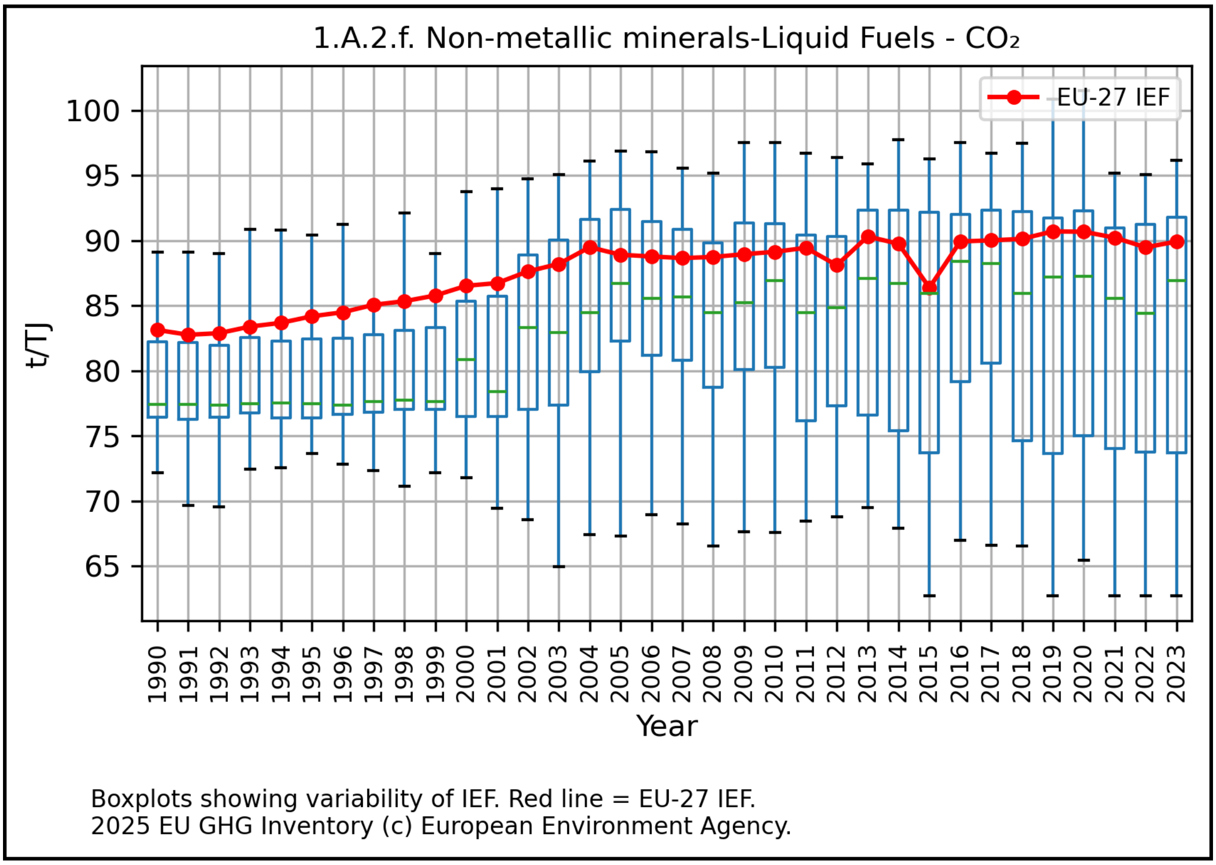


Figure.3.74 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF equalled to 90.08 t/TJ in 2023.

Figure.3.74: 1.A.2.f Non-metallic Minerals, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.f Non-metallic Minerals - Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.f amounted 10 177 kt in 2023 for EU. CO_2 emissions decreased compared to year 1990 by 81 % and compared to 2022 decreased by 20 %. This category represents 2.8 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 80 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.47.

Table 3.47: 1.A.2.f Non-metallic Minerals, solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	535	209	128	1.3%	-407	-76%	-81	-39%	T2	CS
Belgium	2 466	1 043	870	8.5%	-1 596	-65%	-173	-17%	T1,T3	D,PS
Bulgaria	295	239	107	1.0%	-188	-64%	-132	-55%	T1,T2	CS,D
Croatia	535	305	253	2.5%	-282	-53%	-52	-17%	T1	D
Cyprus	232	123	101	1.0%	-131	-56%	-22	-18%	CS	CS
Czechia	2 209	665	499	4.9%	-1 709	-77%	-165	-25%	T2	CS,D
Denmark	574	280	254	2.5%	-320	-56%	-27	-9%	T2,T3	CS,PS
Estonia	595	6	10	0.1%	-585	-98%	3	54%	T2,T3	CS,PS
Finland	806	196	116	1.1%	-690	-86%	-80	-41%	T3	CS
France	4 769	840	781	7.7%	-3 988	-84%	-59	-7%	T1,T2,T3	CS,D,OTH,PS
Germany	12 053	4 186	3 595	35.3%	-8 459	-70%	-591	-14%	CS	CS
Greece	3 364	146	133	1.3%	-3 231	-96%	-13	-9%	T2	PS
Hungary	350	48	31	0.3%	-319	-91%	-17	-35%	T1,T2	D,PS
Ireland	375	281	207	2.0%	-167	-45%	-73	-26%	T2	CS
Italy	3 690	251	198	1.9%	-3 492	-95%	-53	-21%	T2	CS
Latvia	16	32	32	0.3%	16	97%	-1	-2%	T2	CS
Lithuania	60	425	281	2.8%	221	371%	-144	-34%	T2	CS
Luxembourg	312	146	78	0.8%	-235	-75%	-68	-47%	T1	D
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	346	111	82	0.8%	-264	-76%	-29	-26%	T2	CS
Poland	8 576	1 657	1 221	12.0%	-7 355	-86%	-436	-26%	T1,T2	CS,D
Portugal	1 958	2	NO	-	-1 958	-100%	-2	-100%	NA	NA
Romania	285	810	612	6.0%	327	115%	-197	-24%	T2,T3	CS,PS
Slovakia	1 474	417	315	3.1%	-1 159	-79%	-102	-25%	T2	CS
Slovenia	113	48	43	0.4%	-70	-62%	-5	-9%	T1,T3	D,PS
Spain	5 221	329	229	2.3%	-4 992	-96%	-99	-30%	T1,T2	CS,D
Sweden	1 142	C	C	-	-1 142	-100%	-	-	T2	CS
EU-27	**52 351**	**12 794**	**10 177**	**100%**	**-42 174**	**-81%**	**-2 617**	**-20%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.75 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.75: 1.A.2.f Non-metallic Minerals, solid fuels: Emission trend and share for CO_2

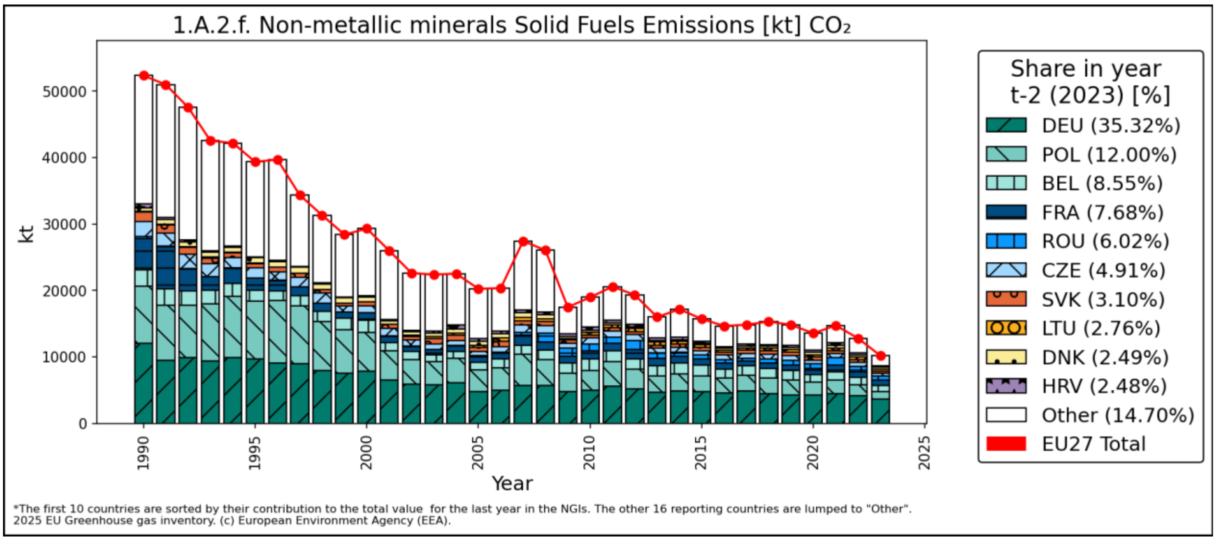
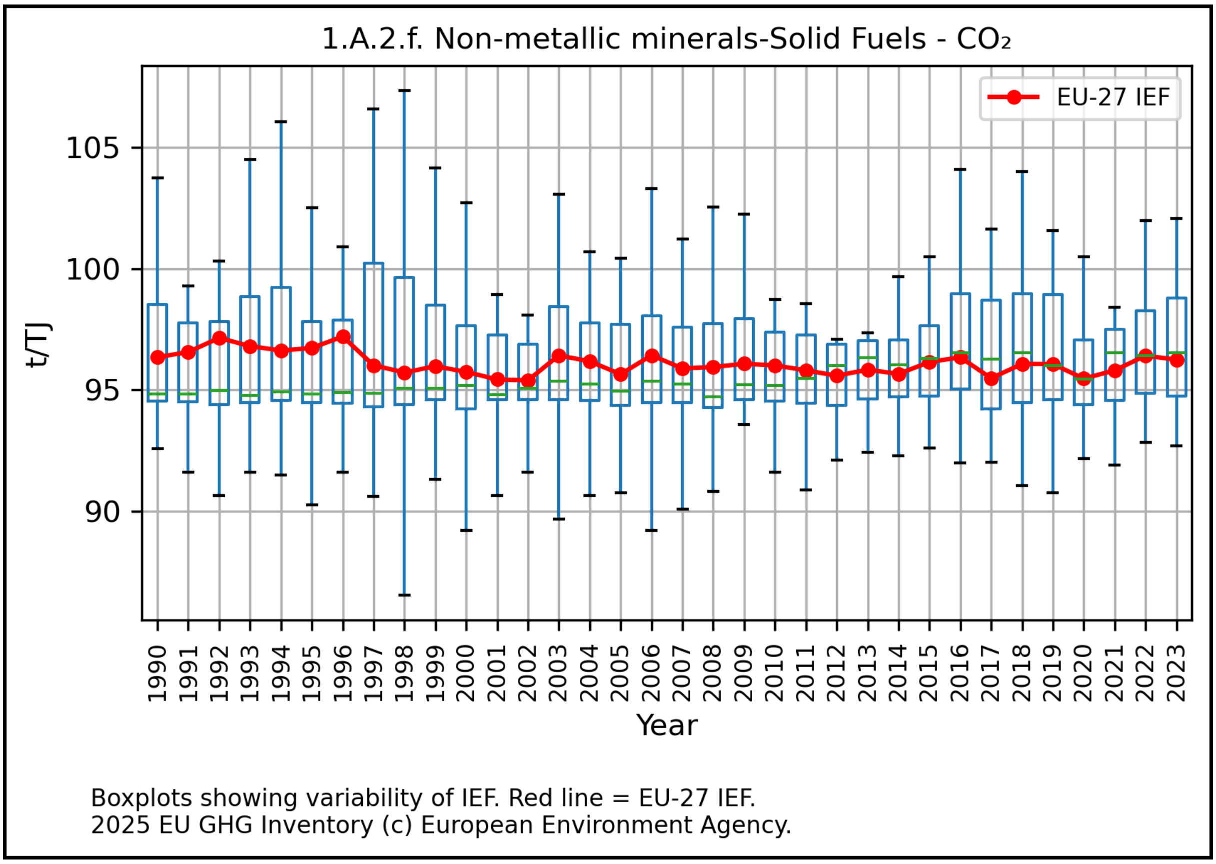


Figure 3.76 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. The IEF slighty fluctuates within the whole time series. CO_2 IEF equalled to 96.2 t/TJ in 2023.

Figure 3.76: 1.A.2.f Non-metallic Minerals, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.f Non-metallic Minerals - Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.f amounted 27 786 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 2 % and compared to 2022 decreased by 10 %. This category represents 7.6 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 0.3 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.48.

Table 3.48: 1.A.2.f Non-metallic Minerals, gaseous fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	559	593	506	1.8%	-53	-9%	-87	-15%	T2	CS
Belgium	1 364	1 166	1 141	4.1%	-223	-16%	-25	-2%	T1,T3	D,PS
Bulgaria	1 684	629	546	2.0%	-1 138	-68%	-83	-13%	T2	CS
Croatia	645	326	321	1.2%	-324	-50%	-5	-1%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	1 289	1 201	1 073	3.9%	-216	-17%	-128	-11%	T2	CS
Denmark	237	196	175	0.6%	-62	-26%	-21	-11%	T3	CS
Estonia	NO	22	23	0.1%	23	∞	1	3%	T2	CS
Finland	126	60	48	0.2%	-77	-62%	-12	-20%	T3	CS
France	3 433	4 210	3 771	13.6%	339	10%	-439	-10%	T1,T2,T3	CS,D,OTH,PS
Germany	3 265	4 400	3 735	13.4%	469	14%	-666	-15%	CS	CS
Greece	NO	152	156	0.6%	156	∞	4	3%	T2	CS
Hungary	1 658	426	267	1.0%	-1 391	-84%	-160	-37%	T2	CS
Ireland	132	53	50	0.2%	-83	-63%	-3	-6%	T2	CS
Italy	5 996	6 388	6 168	22.2%	172	3%	-220	-3%	T2	CS
Latvia	316	59	57	0.2%	-259	-82%	-2	-3%	T2	CS
Lithuania	382	38	27	0.1%	-355	-93%	-10	-28%	T2	CS
Luxembourg	201	13	11	0.0%	-190	-95%	-2	-18%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	1 484	1 041	925	3.3%	-558	-38%	-116	-11%	T2	CS
Poland	1 359	2 539	2 287	8.2%	928	68%	-251	-10%	T2	CS
Portugal	0	1 026	1 000	3.6%	1 000	8113793%	-26	-3%	T1,T3	D,PS
Romania	NO	548	483	1.7%	483	∞	-65	-12%	T2,T3	CS,PS
Slovakia	542	378	297	1.1%	-245	-45%	-81	-21%	T2	CS
Slovenia	116	155	143	0.5%	27	23%	-12	-8%	T2	CS
Spain	2 411	5 038	4 507	16.2%	2 096	87%	-531	-11%	T2	CS
Sweden	65	109	68	0.2%	3	5%	-41	-38%	T2	CS
EU-27	**27 265**	**30 768**	**27 786**	**100%**	**522**	**2%**	**-2 982**	**-10%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.

Figure 3.77 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.77: 1.A.2.f Non-metallic Minerals, gaseous fuels: Emission trend and share for CO_2

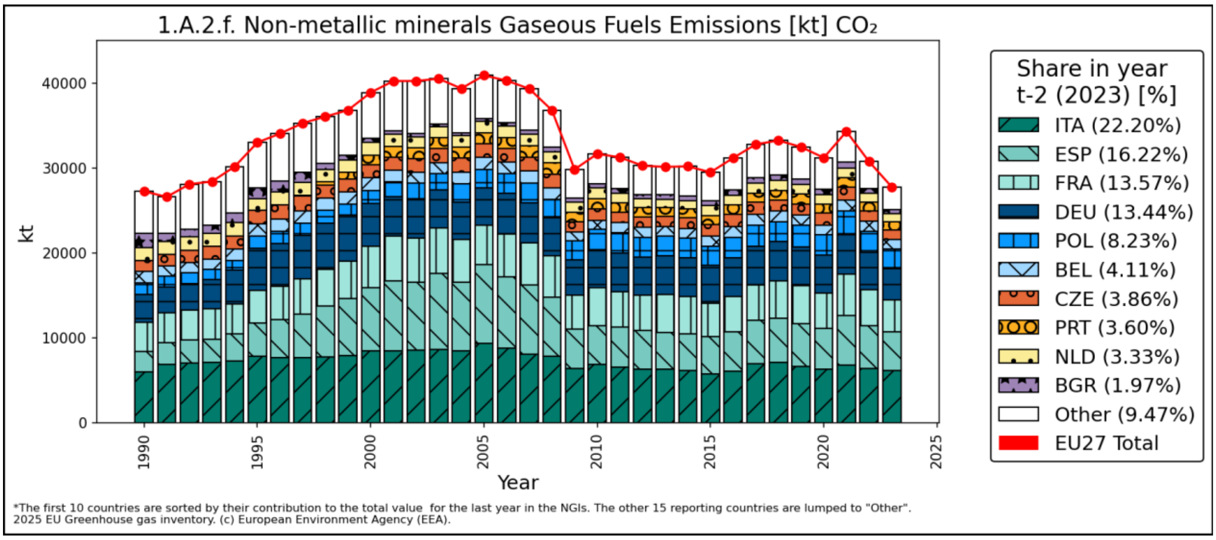
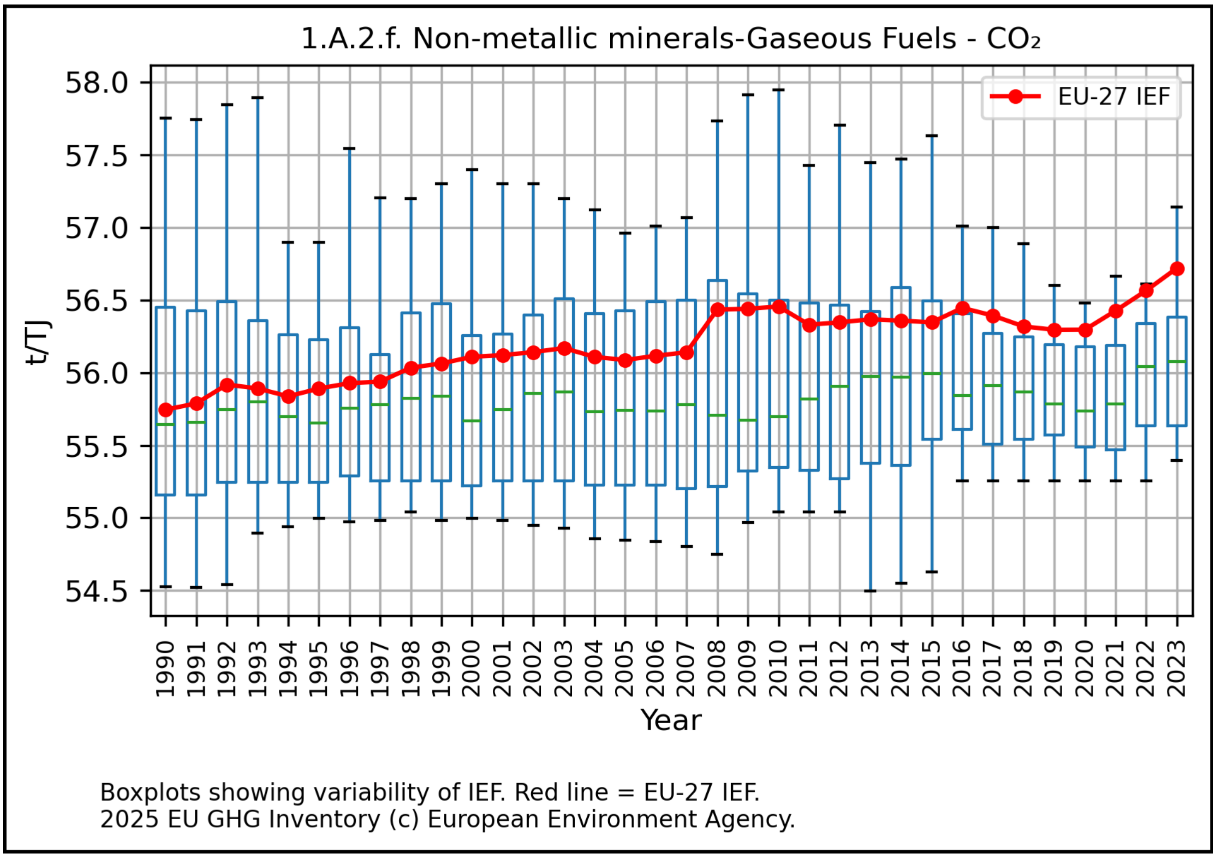


Figure 3.78 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF is stable during whole time period with slightly increasing trend. CO_2 IEF equalled to 56.72 t/TJ in 2023.

Figure 3.78: 1.A.2.f Non-metallic Minerals, gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.f Non-metallic Minerals – Other Fossil Fuels (CO_2)

CO_2 emissions from the use of other fossil fuels in category 1.A.2.f amounted 13 259 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 822 % and decreased by 8% compared to 2022. This category represents 3.6 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 760 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.49.

Table 3.49: 1.A.2.f Non-metallic Minerals, other fossil fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	67	616	554	4.2%	487	724%	-62	-10%	T2	CS
Belgium	186	459	448	3.4%	261	140%	-12	-3%	T1,T3	D,PS
Bulgaria	NO	NO	NO	-	-	-	-	-	NA	NA
Croatia	NO	276	289	2.2%	289	∞	13	5%	T1	D
Cyprus	NO	173	170	1.3%	170	∞	-2	-1%	CS	CS
Czechia	NO	543	552	4.2%	552	∞	8	2%	T2	CS
Denmark	NO	131	135	1.0%	135	∞	5	3%	T3	PS
Estonia	NO	6	7	0.1%	7	∞	1	21%	T3	PS
Finland	NO	59	51	0.4%	51	∞	-8	-14%	T3	CS
France	340	1 135	1 091	8.2%	752	221%	-43	-4%	T1,T2,T3	CS,D,OTH,PS
Germany	526	2 996	2 627	19.8%	2 101	400%	-369	-12%	CS	CS
Greece	NO	205	222	1.7%	222	∞	16	8%	T2	PS
Hungary	NO	300	209	1.6%	209	∞	-91	-30%	T3	PS
Ireland	NO	218	274	2.1%	274	∞	57	26%	T3	PS
Italy	NO	403	459	3.5%	459	∞	55	14%	T2	CS
Latvia	NO	151	159	1.2%	159	∞	8	5%	T2	PS
Lithuania	NO	7	46	0.3%	46	∞	39	545%	T2,T3	OTH,PS
Luxembourg	NO	94	76	0.6%	76	∞	-18	-19%	T1,T3	D,PS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	10	4 254	3 905	29.5%	3 895	40058%	-349	-8%	T1	D
Portugal	12	290	242	1.8%	229	1879%	-49	-17%	T1,T3	D,PS
Romania	NO	993	715	5.4%	715	∞	-278	-28%	T2	CS
Slovakia	173	289	258	1.9%	85	49%	-30	-11%	T2	CS
Slovenia	5	98	96	0.7%	91	1941%	-2	-2%	T1,T3	D,PS
Spain	120	679	675	5.1%	555	464%	-4	-1%	T2	CS,PS
Sweden	NO	C	C	-	-	-	-	-	T2	CS
EU-27	**1 438**	**14 374**	**13 259**	**100%**	**11 821**	**822%**	**-1 115**	**-8%**	**-**	**-**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 1990 EU sum do include emission from Sweden.

Figure 3.79 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.79: 1.A.2.f Non-metallic Minerals, other fossil fuels: Emission trend and share for CO_2

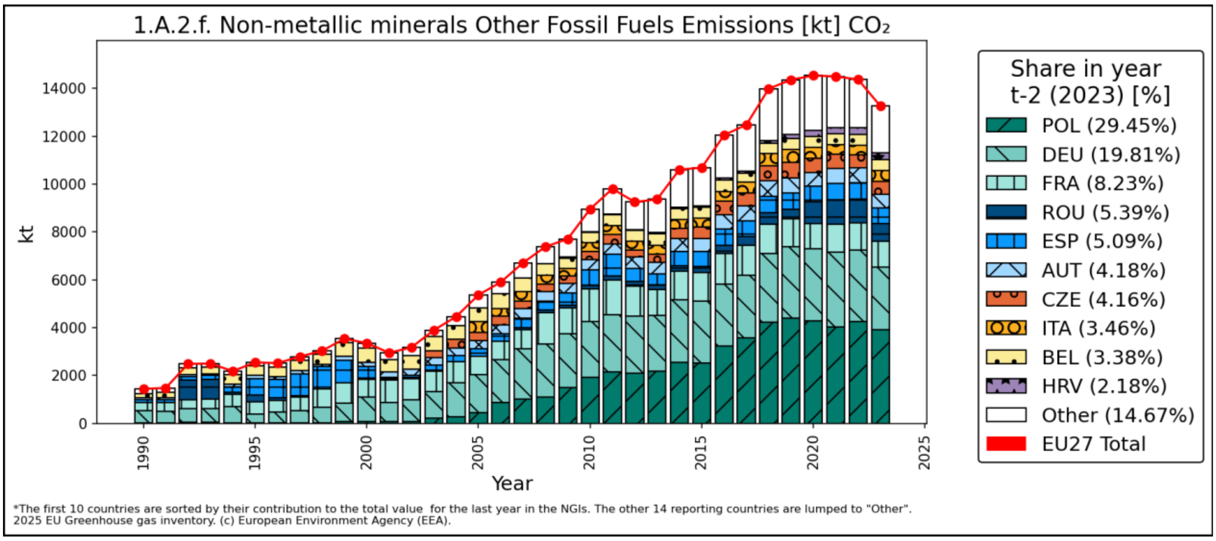
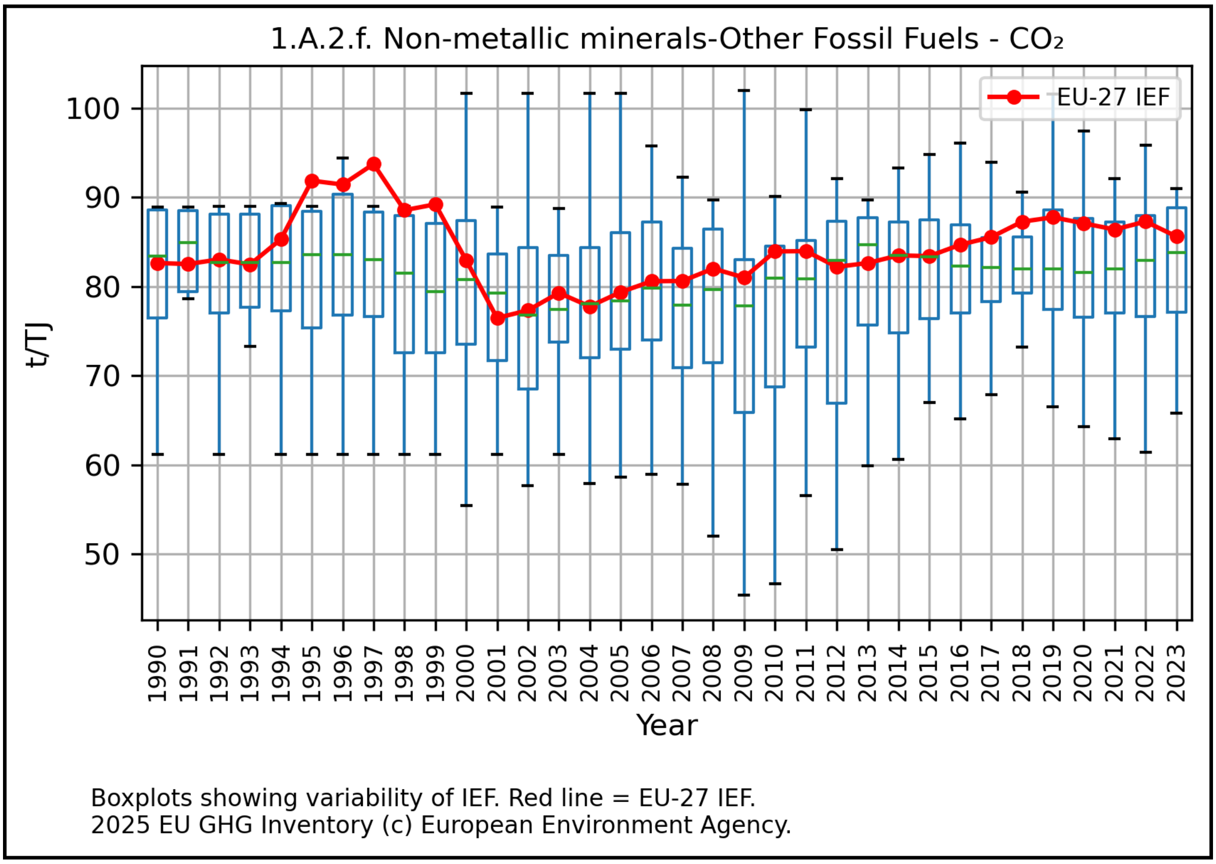


Figure 3.80 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. The CO_2 IEF for year 2023 equalled to 86.07 t/TJ.

Figure 3.80: 1.A.2.f Non-metallic Minerals, other fossil fuels: Implied Emission Factors for CO_2 (in t/TJ)



3.6.2.7 Other (1.A.2.g)

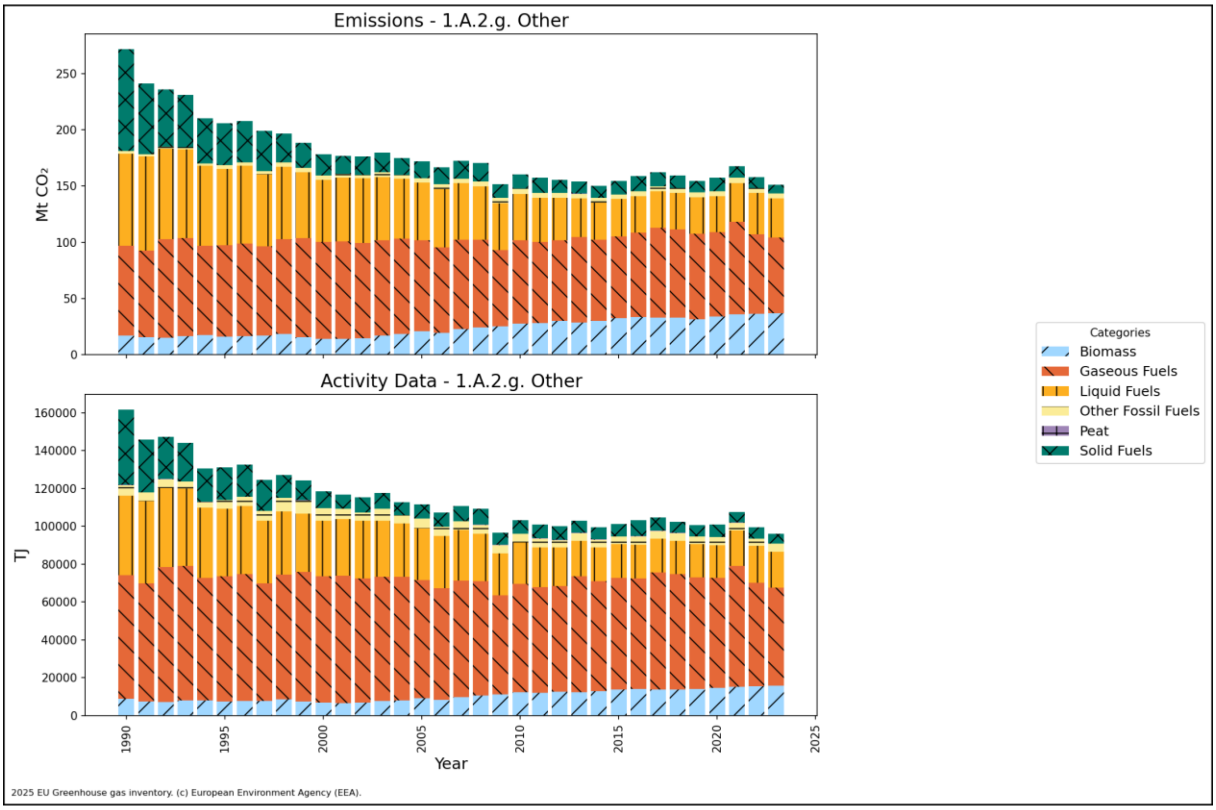
This chapter provides information about European emission trend, Member States contribution to the overall emission trend, activity data and emission factors used for emission estimates by countries for category 1.A.2.g Other.

Emissions for category 1.A.2.g other (manufacturing industries and construction) include emissions from stationary combustion but also may include emissions from mobile sources (e.g. construction machinery). Some countries use this category to report emissions which cannot be allocated to the categories 1.A.2.a to 1.A.2.f due to lack of detailed data, e.g. IEA data provides fuel consumption of Industrial Auto-producers (Electricity, CHP, Heat) for total industry only. This category is dominated by Germany; Germany reports all emissions from power and heat production in industry under this category. Greece reports emissions of 1.A.2.g together with category 1A2f. Ireland presumably includes it in the transport sector (1A3). Cyprus, Czechia, Estonia, France, Malta and Slovakia report data from 1.A.2.g.vii together with agricultural mobile sources under the category 1.A.4.c.ii while Italy and Poland report data under residential or commercial under categories 1.A.4 or 1.A.5.

Total CO_2 emissions from 1.A.2.g amounted to 114 345 kt CO_2 eq. in 2023. The trend of total CO_2 emissions for 1990 to 2023 from category 1.A.2.g is depicted in Figure 3.81. Total CO_2 emissions decreased by 55 % since 1990 and by 6 % between 2022 and 2023. CO_2 emissions from 1.A.2.g Other accounted for 31 % of 1.A.2. source category.

Figure 3.81 shows the emission trend within the category 1.A.2.g which is mainly dominated by CO_2 emissions from gaseous, liquid and solid fuels; the decrease in the early 1990s was mainly due to a decline of solid fuel consumption.

Figure 3.81: 1.A.2.g Other: Activity data and total emission trends



Detailed data related to the EU submissions are depicted in Table 3.50.

Table 3.50: 1.A.2.g Other: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 974	3 057	2 818	2.5%	843	43%	-239	-8%	NA,T2	CS,NA
Belgium	2 883	1 774	1 730	1.5%	-1 153	-40%	-44	-3%	CS,M,NA,T1,T3	CS,D,NA,PS
Bulgaria	10 579	1 077	1 058	0.9%	-9 521	-90%	-19	-2%	NA,T1,T2	CS,D,NA
Croatia	329	400	451	0.4%	122	37%	51	13%	NA,T1	D,NA
Cyprus	38	84	88	0.1%	50	132%	4	5%	NA,T1	D,NA
Czechia	19 064	2 037	1 974	1.7%	-17 090	-90%	-63	-3%	NA,T1,T2	CS,D,NA
Denmark	1 856	1 031	1 006	0.9%	-850	-46%	-25	-2%	NA,T2,T3	CR,CS,D,NA
Estonia	1 163	108	86	0.1%	-1 077	-93%	-22	-20%	T1,T2	CS,D
Finland	1 639	1 595	1 649	1.4%	10	1%	55	3%	NA,T3	CS,NA
France	11 541	7 290	6 956	6.1%	-4 585	-40%	-334	-5%	NA	NA
Germany	125 780	64 444	59 800	52.3%	-65 981	-52%	-4 644	-7%	CS	CS,M
Greece	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Hungary	3 924	1 871	1 673	1.5%	-2 251	-57%	-198	-11%	NA,T1,T2	CS,D,NA
Ireland	797	489	479	0.4%	-318	-40%	-10	-2%	T1,T2	CS,D
Italy	15 310	14 428	13 718	12.0%	-1 592	-10%	-710	-5%	T2	CS
Latvia	1 620	204	210	0.2%	-1 410	-87%	6	3%	NA,T1,T2	CS,D,NA
Lithuania	1 567	221	198	0.2%	-1 370	-87%	-23	-11%	NA,T2	CS,NA
Luxembourg	96	321	328	0.3%	232	241%	8	2%	NA,T1,T2	CS,D,NA,PS
Malta	53	56	35	0.0%	-18	-34%	-21	-38%	NA,T1	D,NA
Netherlands	4 297	2 688	2 652	2.3%	-1 645	-38%	-36	-1%	NA,NO,T2	CS,NA,NO
Poland	6 979	3 086	3 417	3.0%	-3 562	-51%	331	11%	NA,T1,T2	CS,D,NA
Portugal	2 195	1 332	1 202	1.1%	-992	-45%	-130	-10%	NA	NA
Romania	26 456	5 418	5 378	4.7%	-21 079	-80%	-41	-1%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	2 560	1 007	959	0.8%	-1 601	-63%	-48	-5%	NA,T2	CS,NA
Slovenia	1 094	406	437	0.4%	-657	-60%	31	8%	NA,T1,T2	CS,D,NA
Spain	7 728	5 419	4 892	4.3%	-2 836	-37%	-527	-10%	CR,NA,T1,T2,T3	R,CS,D,NA,PS
Sweden	3 197	1 607	1 154	1.0%	-2 043	-64%	-453	-28%	T2	CS
EU-27	**254 717**	**121 449**	**114 345**	**100%**	**-140 372**	**-55%**	**-7 104**	**-6%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'. Presented methods and emission factor information refer to the last inventory year.
Greece includes emissions of 1.A.2.g in category 1.A.2.f

1.A.2.g Other – Liquid Fuels (CO_2)

CO_2 emissions from the use of liquid fuels in category 1.A.2.g amounted 34 765 kt in 2023 for EU. CO_2 emissions decreased compared to the year 1990 by 57 % and decreased by 5 % compared to 2022. This category represents 9.6 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 54 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table.3.51.

Table.3.51: 1.A.2.g Other, liquid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	866	1 509	1 511	4.3%	645	74%	2	0%
Belgium	1 646	928	956	2.7%	-691	-42%	27	3%
Bulgaria	8 632	458	387	1.1%	-8 245	-96%	-71	-16%
Croatia	329	400	451	1.3%	122	37%	51	13%
Cyprus	38	84	88	0.3%	50	132%	4	5%
Czechia	2 935	97	156	0.4%	-2 779	-95%	59	61%
Denmark	1 242	889	874	2.5%	-368	-30%	-16	-2%
Estonia	683	66	59	0.2%	-623	-91%	-7	-10%
Finland	1 480	1 255	1 230	3.5%	-250	-17%	-25	-2%
France	6 322	4 101	4 079	11.7%	-2 243	-35%	-22	-1%
Germany	28 162	11 166	10 053	28.9%	-18 109	-64%	-1 113	-10%
Greece	IE	IE	IE	-	-	-	-	-
Hungary	1 160	840	724	2.1%	-436	-38%	-116	-14%
Ireland	625	266	267	0.8%	-357	-57%	1	0%
Italy	5 707	5 426	5 256	15.1%	-451	-8%	-170	-3%
Latvia	1 066	149	155	0.4%	-912	-85%	5	4%
Lithuania	812	77	77	0.2%	-734	-90%	0	0%
Luxembourg	52	280	287	0.8%	234	447%	7	3%
Malta	53	56	35	0.1%	-18	-34%	-21	-38%
Netherlands	2 545	1 679	1 693	4.9%	-852	-33%	14	1%
Poland	1 028	778	1 386	4.0%	357	35%	607	78%
Portugal	2 145	560	506	1.5%	-1 639	-76%	-54	-10%
Romania	4 826	1 469	1 503	4.3%	-3 324	-69%	34	2%
Slovakia	66	19	19	0.1%	-47	-71%	1	5%
Slovenia	586	169	163	0.5%	-423	-72%	-6	-4%
Spain	5 685	2 108	1 746	5.0%	-3 939	-69%	-362	-17%
Sweden	2 985	1 600	1 104	3.2%	-1 881	-63%	-496	-31%
EU-27	**81 677**	**36 429**	**34 765**	**100%**	**-46 913**	**-57%**	**-1 664**	**-5%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Greece includes emissions of 1.A.2.g in category 1.A.2.f
The information on methodologies and emission factors is not available from the JSON on fuels level. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.82 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.82: 1.A.2.g Other, liquid fuels: Emission trend and share for CO_2

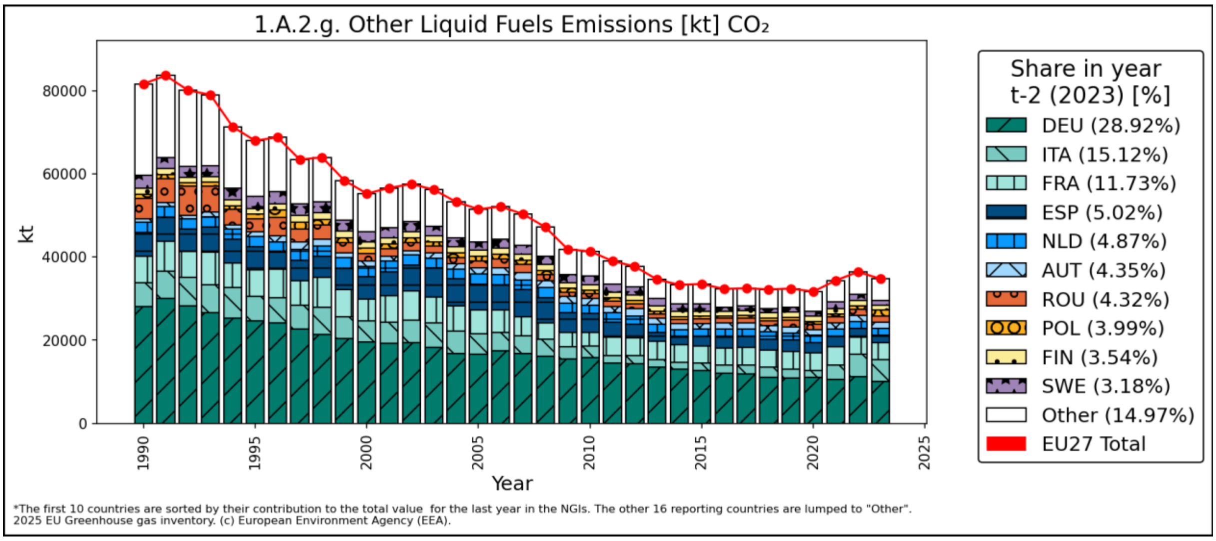
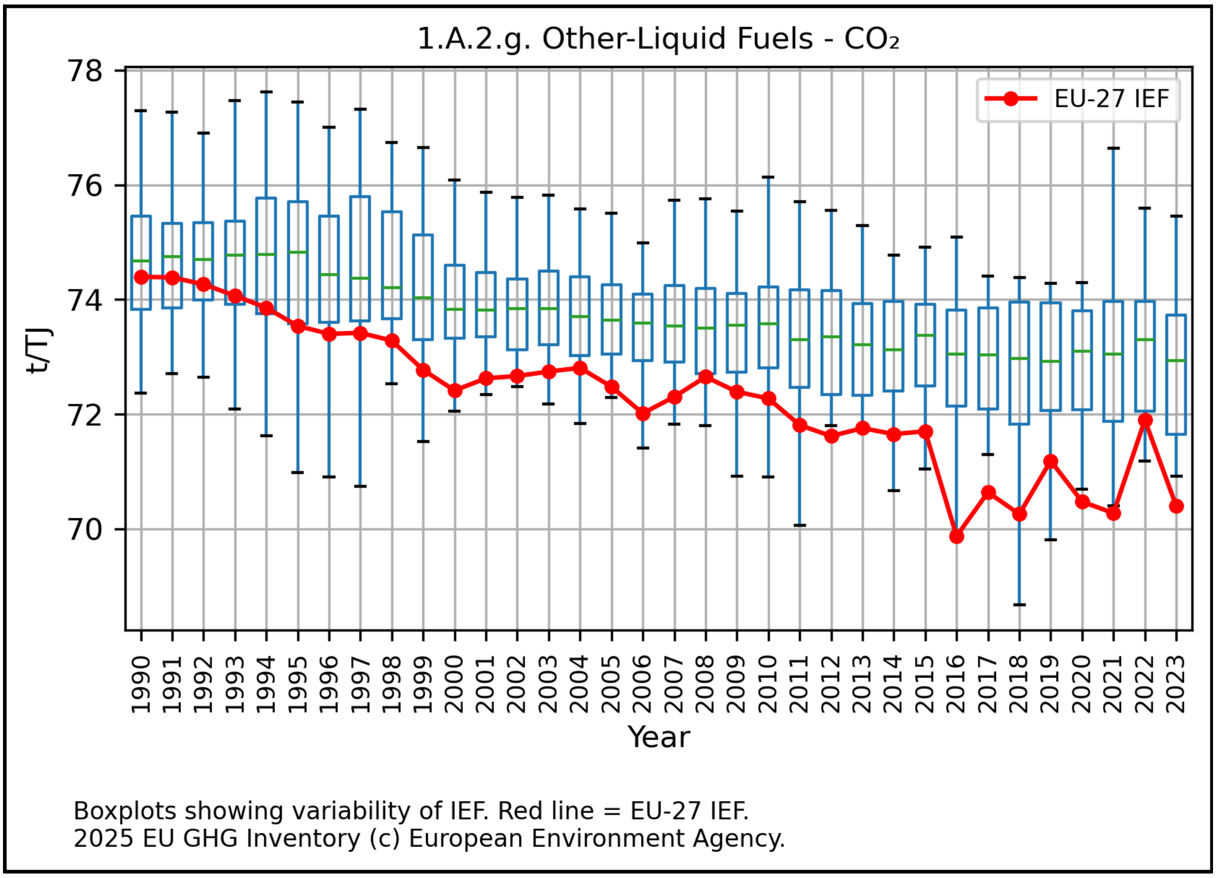


Figure 3.83 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. The CO_2 IEF shows a decreasing trend with minor fluctuations since 2015. This trend is driven mainly by Germany and is caused by changes in fuel mix. CO_2 IEF equaled to 70.33 t/TJ in 2023.

Figure 3.83: 1.A.2.g Other, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.g Other – Solid Fuels (CO_2)

CO_2 emissions from the use of solid fuels in category 1.A.2.g amounted 7 532 kt in 2023 for EU. CO_2 emissions decreased compared to the year 1990 by 92 % and compared to 2022 decreased by 25 %. This category represents 2 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 91 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.52.

Table 3.52: 1.A.2.g Other, solid fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	91	2	0	0.0%	-91	-100%	-2	-98%
Belgium	33	19	17	0.2%	-16	-48%	-2	-9%
Bulgaria	1 858	44	65	0.9%	-1 793	-97%	21	48%
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	13 750	123	113	1.5%	-13 638	-99%	-10	-8%
Denmark	324	13	NO	-	-324	-100%	-13	-100%
Estonia	194	NO	NO	-	-194	-100%	-	-
Finland	8	NO	NO	-	-8	-100%	-	-
France	808	97	111	1.5%	-697	-86%	14	14%
Germany	57 580	7 857	6 143	81.6%	-51 438	-89%	-1 715	-22%
Greece	IE	IE	IE	-	-	-	-	-
Hungary	406	23	24	0.3%	-383	-94%	0	2%
Ireland	14	NO	NO	-	-14	-100%	-	-
Italy	396	734	162	2.1%	-234	-59%	-573	-78%
Latvia	27	1	2	0.0%	-25	-93%	1	186%
Lithuania	79	1	2	0.0%	-77	-98%	1	100%
Luxembourg	20	8	7	0.1%	-13	-63%	0	-1%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	42	3	NO	-	-42	-100%	-3	-100%
Poland	5 082	747	543	7.2%	-4 539	-89%	-204	-27%
Portugal	49	14	8	0.1%	-41	-84%	-6	-42%
Romania	8 006	4	2	0.0%	-8 004	-100%	-1	-38%
Slovakia	1 422	343	334	4.4%	-1 088	-77%	-9	-3%
Slovenia	89	NO	NO	-	-89	-100%	-	-
Spain	226	NO	NO	-	-226	-100%	-	-
Sweden	98	-	-	-	-98	-100%	-	-
EU-27	**90 603**	**10 032**	**7 532**	**100%**	**-83 071**	**-92%**	**-2 500**	**-25%**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
Greece includes emissions of 1.A.2.g in category 1.A.2.f
The information on methodologies and emission factors is not available from the JSON on fuels level. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure.3.84 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure.3.84: 1.A.2.g Other, solid fuels: Emission trend and share for CO_2

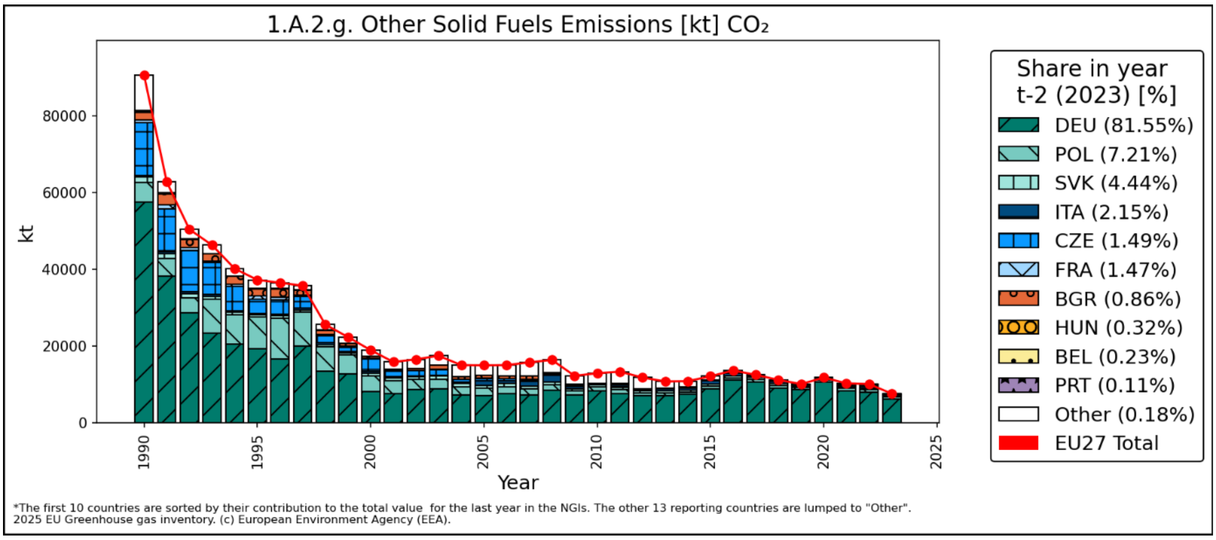
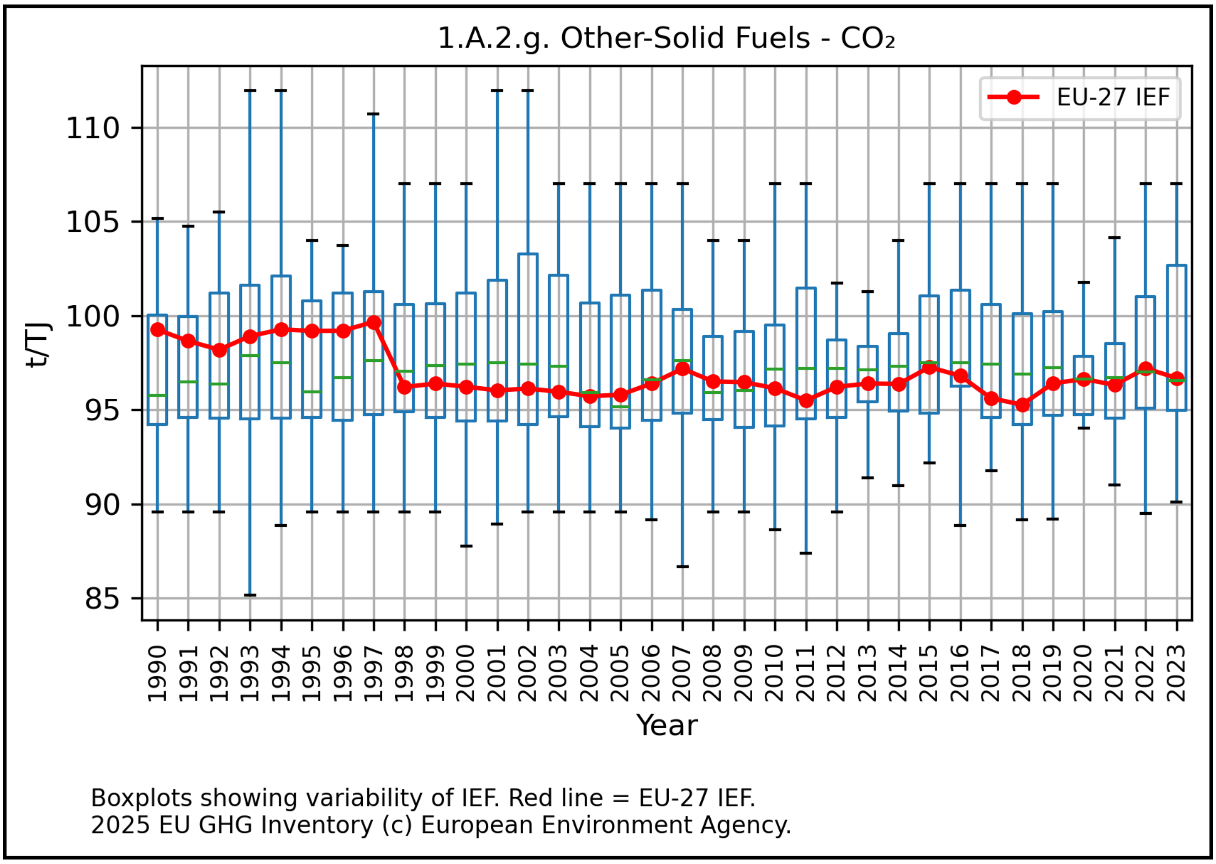


Figure 3.85 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023 which is fluctuating. CO_2 IEF equaled to 96.69 t/TJ in 2023.

Figure 3.85: 1.A.2.g Other, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.g Other – Gaseous Fuels (CO_2)

CO_2 emissions from the use of gaseous fuels in category 1.A.2.g amounted 67 434 kt in 2023 for EU. The is a decrease of 16 % between 1990 and 2023 CO_2 emissions and 5 % decrease between 2022 and 2023. This category represents 19 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption decreased by 17 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.53.

Table 3.53: 1.A.2.g Other, gaseous fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	1 014	1 511	1 270	1.9%	257	25%	-241	-16%
Belgium	1 204	813	745	1.1%	-459	-38%	-67	-8%
Bulgaria	89	298	281	0.4%	192	216%	-17	-6%
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	2 379	1 818	1 706	2.5%	-673	-28%	-112	-6%
Denmark	289	128	126	0.2%	-163	-56%	-2	-2%
Estonia	286	42	27	0.0%	-260	-91%	-15	-36%
Finland	41	21	36	0.1%	-5	-12%	15	68%
France	4 400	3 073	2 746	4.1%	-1 654	-38%	-327	-11%
Germany	37 693	41 886	39 838	59.1%	2 144	6%	-2 048	-5%
Greece	IE	IE	IE	-	-	-	-	-
Hungary	2 358	1 008	925	1.4%	-1 432	-61%	-82	-8%
Ireland	158	223	212	0.3%	54	34%	-11	-5%
Italy	9 207	8 268	8 300	12.3%	-907	-10%	32	0%
Latvia	527	50	53	0.1%	-474	-90%	2	5%
Lithuania	677	142	118	0.2%	-558	-83%	-24	-17%
Luxembourg	24	11	12	0.0%	-12	-50%	1	9%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	1 710	1 002	955	1.4%	-755	-44%	-47	-5%
Poland	865	1 543	1 467	2.2%	602	70%	-76	-5%
Portugal	IE,NO	756	688	1.0%	688	∞	-68	-9%
Romania	13 624	3 941	3 872	5.7%	-9 751	-72%	-69	-2%
Slovakia	1 071	646	606	0.9%	-465	-43%	-40	-6%
Slovenia	420	231	265	0.4%	-155	-37%	34	15%
Spain	1 816	3 311	3 145	4.7%	1 329	73%	-166	-5%
Sweden	113	NO	41	0.1%	-72	-64%	41	∞
EU-27	**79 964**	**70 722**	**67 434**	**100%**	**-12 531**	**-16%**	**-3 289**	**-5%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Greece includes emissions of 1.A.2.g in category 1.A.2.f
Abbreviations explained in the Chapter 'Units and abbreviations'.
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.86 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.86: 1.A.2.g Other, gaseous fuels: Emission trend and share for CO_2

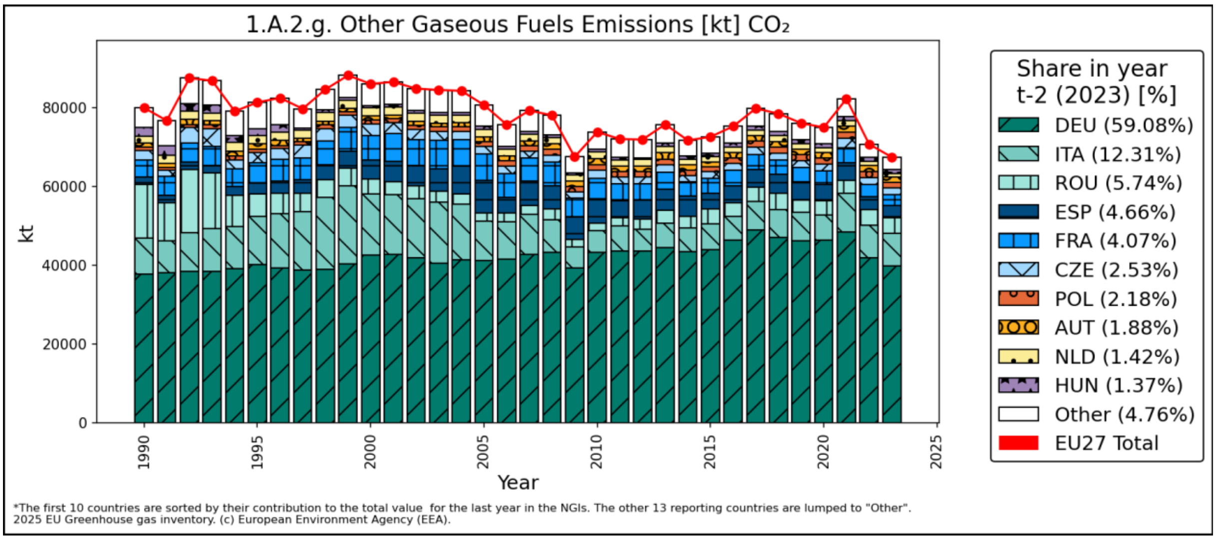
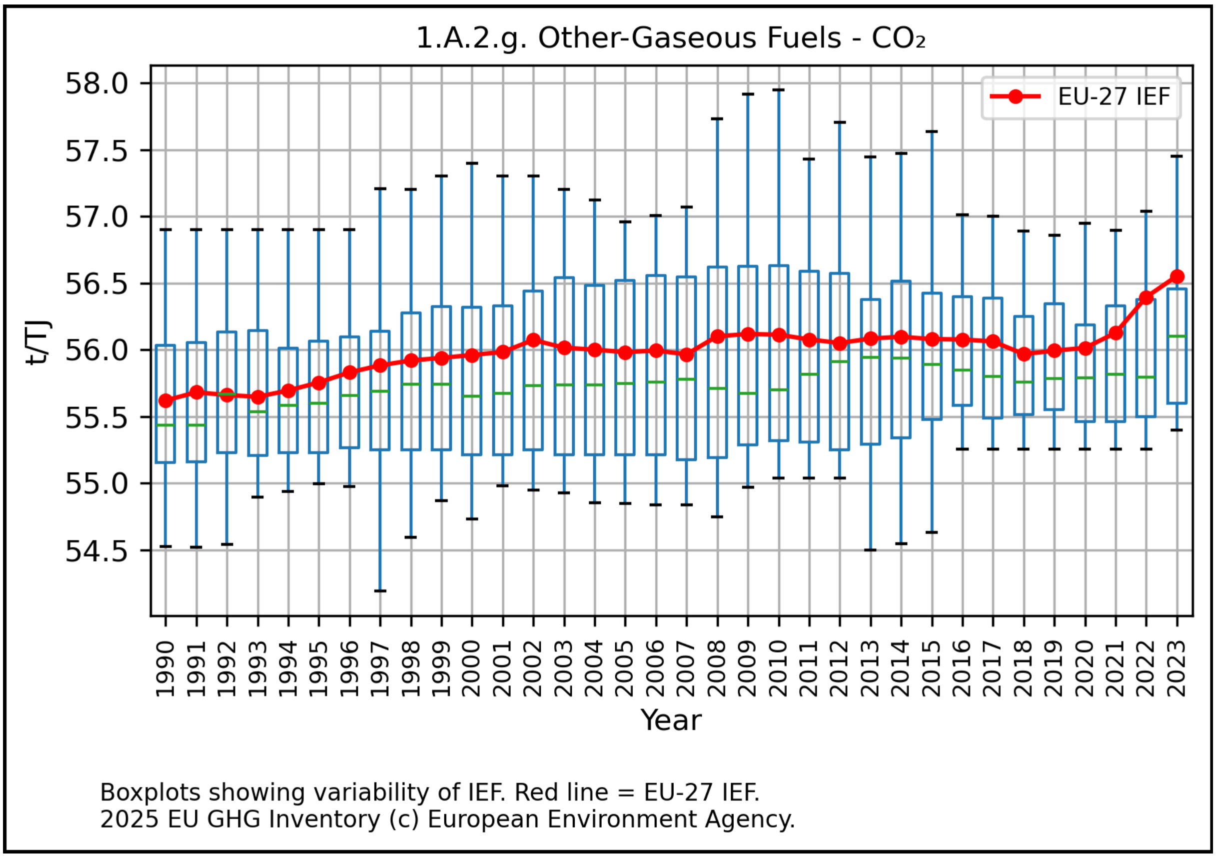


Figure 3.87 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF is relatively stable during reporting period. CO_2 IEF equaled to 56.55 t/TJ in 2023.

Figure 3.87: 1.A.2.g Other, gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.2.g Other – Other fossil fuels (CO_2)

CO_2 emissions from the use of other fossil fuels in category 1.A.2.g amounted 4 576 kt in 2023 for EU. CO_2 emissions increased compared to year 1990 by 87 % and compared to 2022 increased by 8 %. This category represents 1.3 % of total CO_2 equivalent emissions from category 1.A.2. Fuel consumption increased by 81 % compared to 1990.

Detailed data related to the EU submissions are depicted in Table 3.54.

Table 3.54: 1.A.2.g Other, other fossil fuels: Member States contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	3	34	36	0.8%	32	940%	2	6%
Belgium	NO	14	12	0.3%	12	∞	-2	-16%
Bulgaria	NO	278	325	7.1%	325	∞	48	17%
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	0	0	0.0%	0	∞	0	-8%
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	1	1	6	0.1%	5	510%	5	495%
Estonia	NO	NO	NO	-	-	-	-	-
Finland	88	294	344	7.5%	256	292%	50	17%
France	11	20	21	0.5%	10	87%	1	6%
Germany	2 344	3 535	3 766	82.3%	1 422	61%	231	7%
Greece	IE	IE	IE	-	-	-	-	-
Hungary	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	NO	NO	NO	-	-	-	-	-
Latvia	NO	NO	NO	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-
Luxembourg	NO	23	22	0.5%	22	∞	0	-2%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	NO	4	4	0.1%	4	∞	0	-8%
Poland	3	17	21	0.5%	17	554%	3	18%
Portugal	IE,NO	2	IE,NO	-	-	-	-2	-100%
Romania	NO	4	0	0.0%	0	∞	-4	-93%
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NO	6	9	0.2%	9	∞	3	51%
Spain	NO	NO	NO	-	-	-	-	-
Sweden	NO	8	9	0.2%	9	∞	1	16%
EU-27	**2 451**	**4 239**	**4 576**	**100%**	**2 124**	**87%**	**337**	**8%**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
Abbreviations explained in the Chapter 'Units and abbreviations'.
The information on methodologies and emission factors are only partially available from the JSON on fuels level.

Figure 3.88 shows CO_2 emissions trend as well as the share of the countries with the highest contribution to the total CO_2 emissions.

Figure 3.88: 1.A.2.g Other, other fossil fuels: Emission trend and share for CO_2

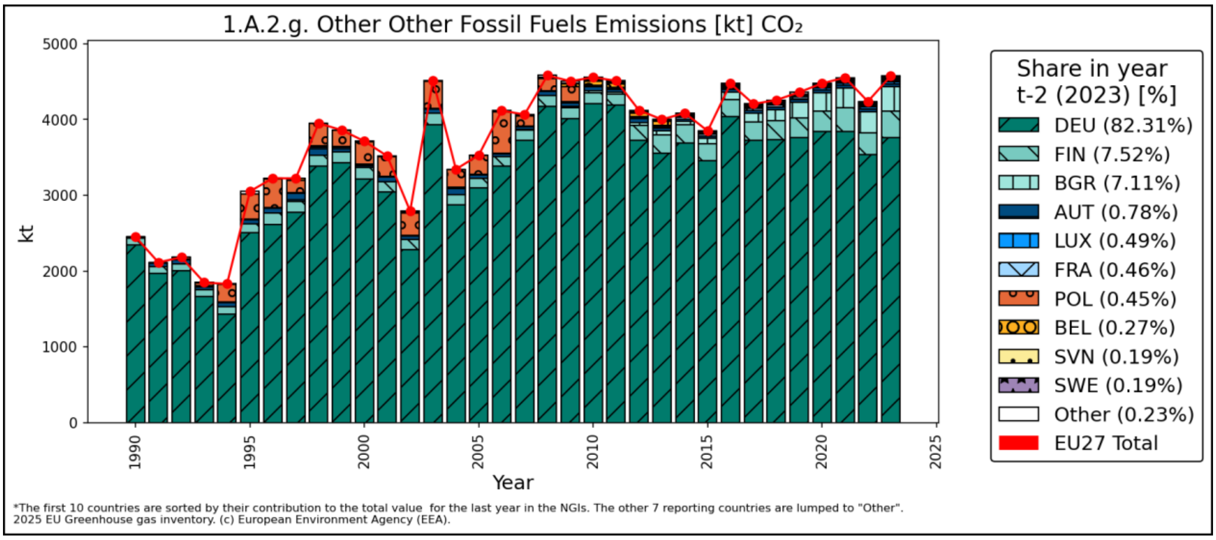
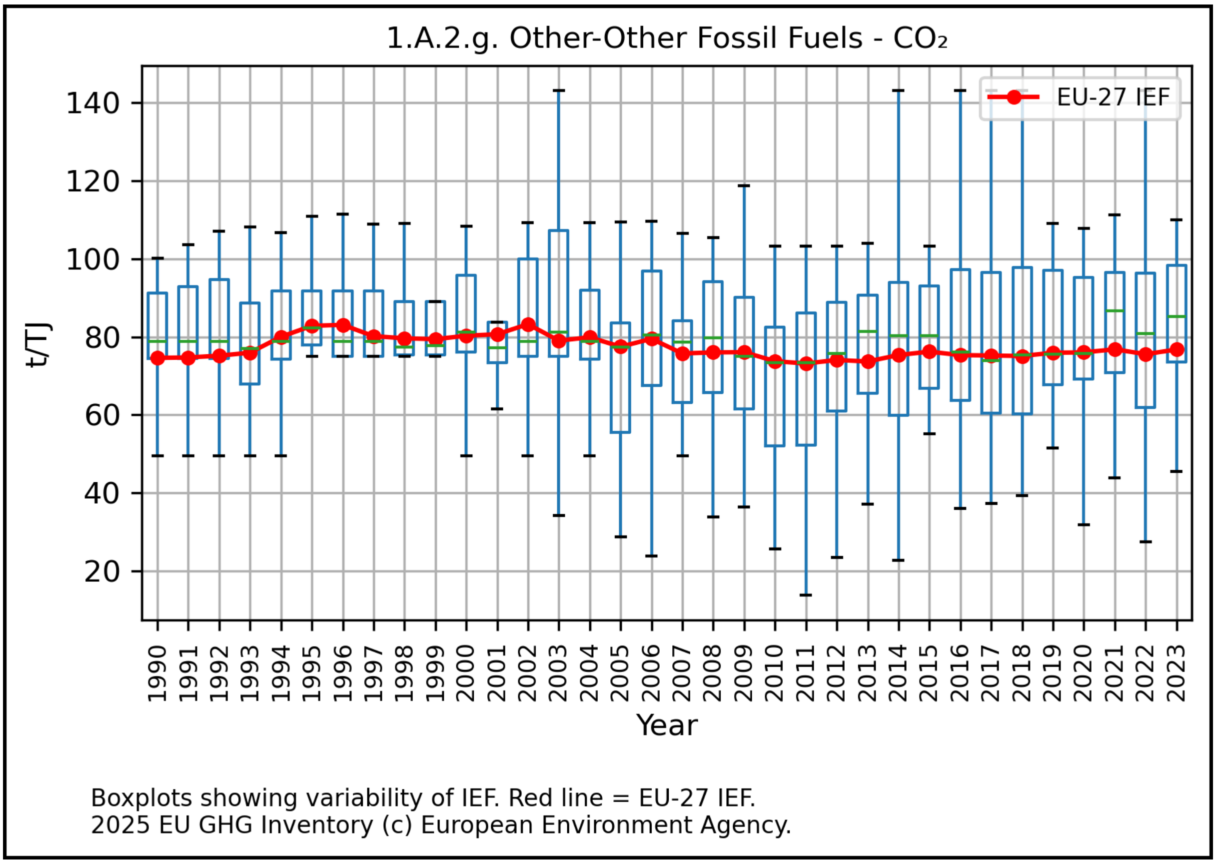


Figure 3.89 shows CO_2 implied emission factor (CO_2 IEF) calculated from EU submissions for 1990-2023. CO_2 IEF equaled to 76.73 t/TJ in 2023.

Figure 3.89: 1.A.2.g Other, other fossil fuels: Implied Emission Factors for CO_2 (in t/TJ)



3.6.3 Transport (CRT Source Category 1A3) (EU)

The time series of greenhouse gas (GHG) emissions and activity data from 1A3 Transport, years 1990-2023, are shown in Figure 3.90. In 2023, CO_2 emissions from the transport sector accounted for 25.9%, CH_4 for 0.04 %, and N_2O for 0.25 % of total GHG emissions from all sources (including indirect CO_2, with LULUCF and international aviation).

Figure 3.90 1A3 Transport: Greenhouse gas emissions (in kt of CO_2 equ.) and activity data (in TJ)

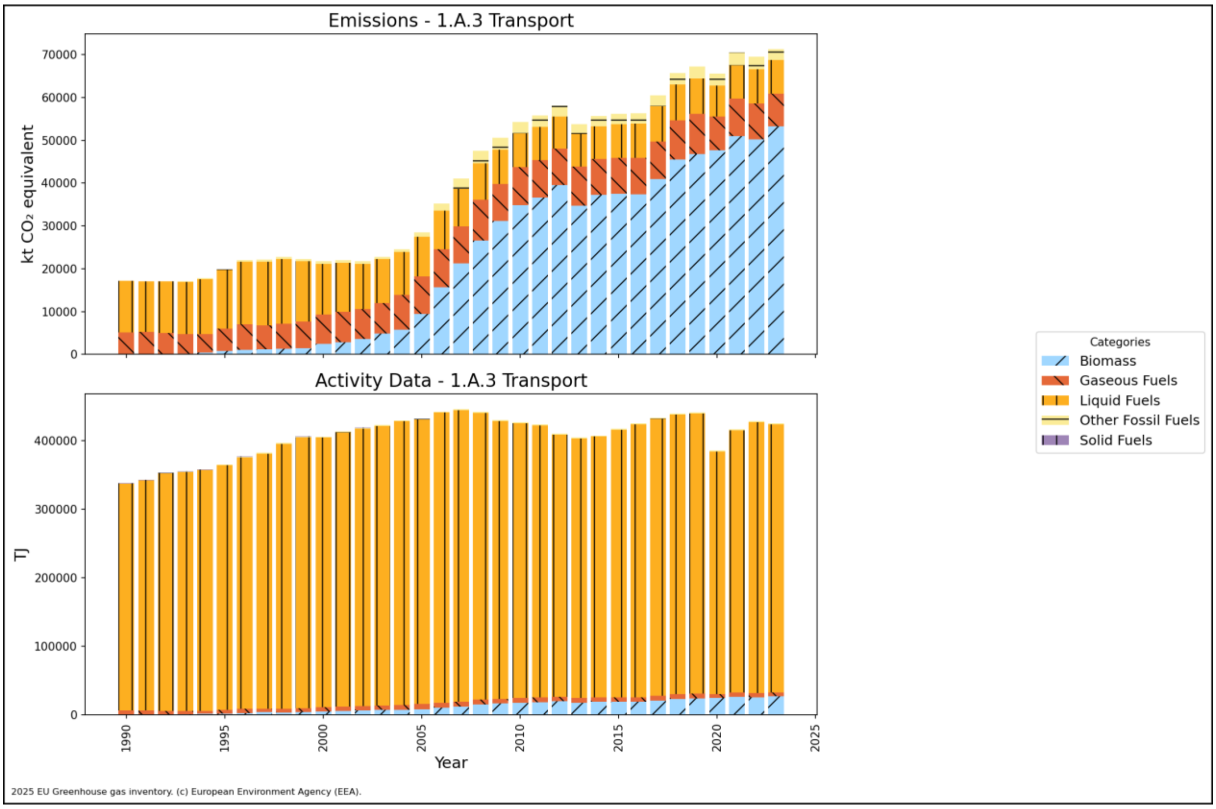


Table 3.55*: Key category analysis for the EU (1A3): Key source categories for level and trend analyses and share of countries using higher tier methods* summarizes the share of countries using higher tier methods for calculating emissions for the key categories of the transport sector. If the information on the tier methods used was not available, the countries NIDs were studied in order to obtain it and calculate the share of higher tiers. In general, most countries use higher tier methods, especially for road transport (83 - 99.8 %) and domestic aviation (94.1 %). Lower percentages are observed for domestic navigation (73.7 - 74.3 %) and railways (95 %). It should be noted that as 'high tier' are considered all methods apart from T1.

Table 3.55: Key category analysis for the EU (1A3): Key source categories for level and trend analyses and share of countries using higher tier methods

Source category (gas)	kt CO_2 equ.		Trend	Level		Share of higher Tier
	1990	2023		1990	2023	
1.A.3.a. Domestic aviation: Jet Kerosene (CO_2)	10822	12937	T	L	L	94.1 %
1.A.3.b. Road transportation: Diesel Oil (CO_2)	270666	517316	T	L	L	83 %
1.A.3.b. Road transportation: Diesel Oil (N_2O)	1336	5725	T	0	L	95.6 %
1.A.3.b. Road transportation: Gaseous Fuels (CO_2)	508	4110	T	0	0	91.4 %
1.A.3.b. Road transportation: Gasoline (CH_4)	5563	678	T	0	0	97.4 %
1.A.3.b. Road transportation: Gasoline (CO_2)	330722	209908	0	L	L	90 %

Source category (gas)	kt CO_2 equ.		Trend	Level		Share of higher Tier
	1990	2023		1990	2023	
1.A.3.b. Road transportation: Liquefied Petroleum Gases (LPG) (CO_2)	7428	15103	T	L	L	99.8 %
1.A.3.c. Railways: Liquid Fuels (CO_2)	11549	3182	T	L	0	73.7 %
1.A.3.d. Domestic navigation: Gas/Diesel Oil (CO_2)	13286	9693	0	L	L	74.3 %
1.A.3.d. Domestic navigation: Residual Fuel Oil (CO_2)	7835	5101	0	L	L	65.7%
1.A.3.b. Road transportation: Other Fuels (CO_2)	1	2592	T	0	0	95%

Table 3.56 shows the total GHG, CO_2, N_2O, and CH_4 emissions from 1A3 Transport per country and at EU level. Between 1990 and 2023, total GHG from transport increased by 18 % in the EU.

Table 3.56 1A3 Transport: Total GHG, CO_2, N_2O, CH_4, emissions per country (in kt of CO_2 equ.)

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023	1990	2023
ustria	13 950	19 842	13 754	19 597	113	222	84	22
elgium	20 968	24 671	20 652	24 424	159	230	158	16
ulgaria	6 516	10 159	6 345	10 048	95	91	77	20
oatia	3 899	7 582	3 787	7 505	65	68	47	10
yprus	1 238	2 161	1 219	2 146	10	12	8	3
zechia	11 275	19 897	11 078	19 684	102	187	95	26
enmark	10 740	11 848	10 563	11 725	88	115	89	8
stonia	2 571	2 648	2 511	2 618	35	28	25	3
nland	12 091	9 441	11 821	9 357	143	72	126	12
ance	123 224	123 431	121 247	122 158	838	1 109	1 139	163
ermany	164 457	146 079	161 430	144 487	1 183	1 350	1 845	243
reece	14 503	17 537	14 137	17 253	242	218	124	66
ungary	8 936	13 969	8 749	13 812	110	138	77	19
eland	5 143	11 798	5 030	11 658	59	129	55	10
aly	102 191	108 994	100 319	107 942	861	884	1 010	168
atvia	3 037	3 134	2 940	3 096	73	35	24	3
huania	5 811	6 147	5 685	6 078	81	60	45	8
uxembourg	2 627	4 064	2 599	4 020	14	41	14	3
alta	351	765	346	759	2	5	3	1
etherlands	27 948	26 522	27 653	26 155	96	300	200	67
oland	20 744	68 346	20 315	67 623	273	645	156	78
ortugal	10 821	18 241	10 618	18 068	91	152	111	22
omania	12 432	22 125	12 071	21 833	256	255	105	38
ovakia	6 816	7 736	6 693	7 648	89	82	34	5
ovenia	2 737	5 364	2 673	5 308	33	52	31	4
pain	58 651	87 698	57 728	86 758	463	821	461	119
veden	20 372	14 197	20 017	13 985	171	174	183	37
U-27	**674 050**	**794 394**	**661 981**	**785 743**	**5 745**	**7 476**	**6 324**	**1 175**

3.6.3.1 Domestic Aviation (1A3a) (EU)

This mobile source category includes emissions from civil domestic aviation, i.e. passenger and freight activity of flights having their origin and destination (O-D) within the same country. The main fuel used is jet kerosene, while there is also a small part of aviation gasoline. The emissions from military mobile sources related to aviation are excluded from 1A3a and are reported separately under category 1A5b (Other mobile military use).

CO_2 emissions from 1A3a Domestic Aviation

CO_2 emissions from domestic aviation accounted only for 0.4% of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only domestic aviation, CO_2 accounted for 99.2 % of total GHG emissions from domestic aviation in EU, 2023.

The time series of CO_2 emissions and activity data from 1A3a Domestic aviation, years 1990-2023, are shown in Figure 3.91.

Figure 3.91 1A3a Domestic Aviation: CO_2 emissions (in kt) and activity data (in TJ)

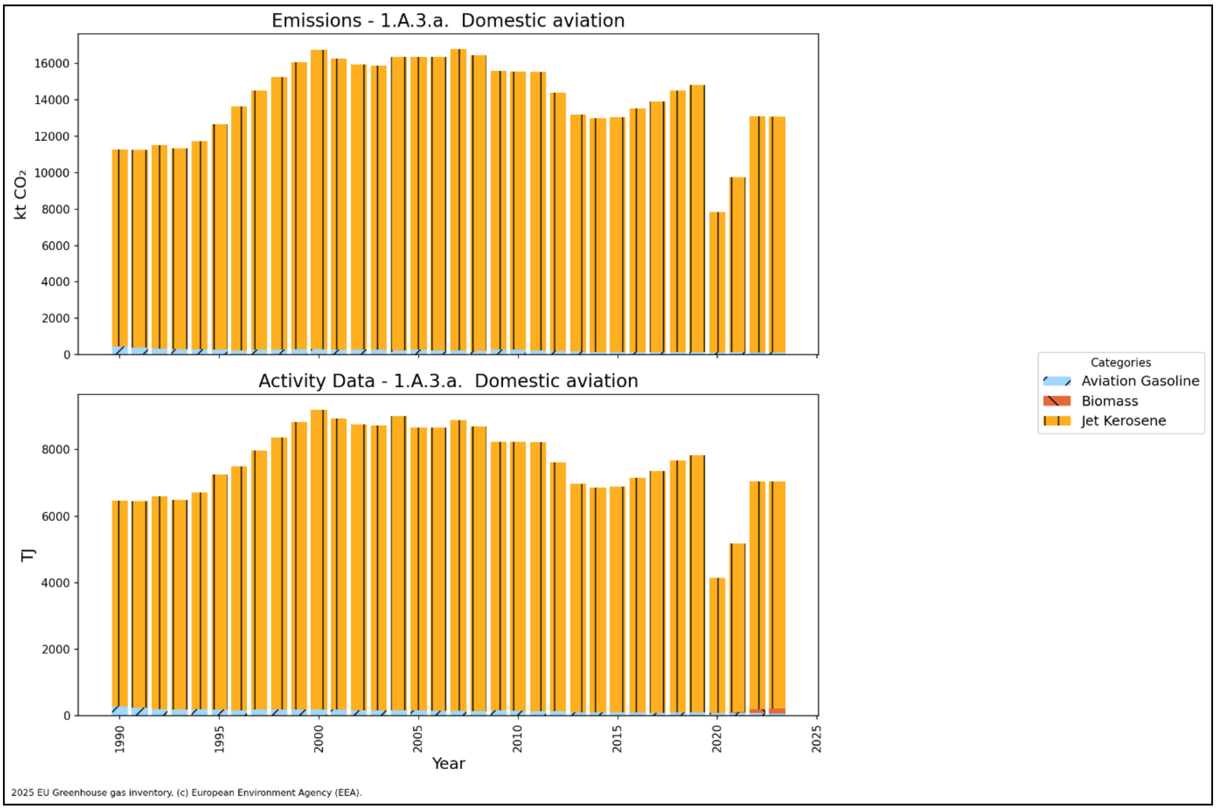


Table 3.57 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for domestic aviation. Between 1990 and 2023, CO_2 emissions from domestic aviation increased by 16% in the EU, while between 2022 and 2023 the corresponding change was 0.2 % decrease. Top three countries in 2023 were France, Spain, and Italy, which accounted for the 77 % of the EU value.

Table 3.57 1A3a Domestic Aviation: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	38	30	30	0.2%	-8	-21%	1	3%	T2,T3	CS,D
Belgium	15	8	8	0.1%	-6	-44%	0	5%	T1	D
Bulgaria	50	17	17	0.1%	-32	-65%	1	5%	NA,T3	CR,NA
Croatia	7	26	30	0.2%	24	357%	4	17%	T1	D
Cyprus	26	1	1	0.0%	-25	-96%	0	-6%	NA,T3	M,NA
Czechia	IE	12	12	0.1%	12	∞	0	0%	T1,T2	M
Denmark	215	118	122	0.9%	-93	-43%	4	4%	T2	CS
Estonia	6	5	6	0.0%	0	0%	1	14%	NA,T2	D,NA
Finland	385	137	135	1.0%	-251	-65%	-2	-2%	T1,T2	CS
France	3 631	4 585	4 375	33.5%	744	20%	-209	-5%	T3	D
Germany	2 310	1 031	1 082	8.3%	-1 228	-53%	52	5%	CS,T1,T2	CS,D,M
Greece	336	389	416	3.2%	80	24%	27	7%	T2,T3	D
Hungary	6	7	7	0.1%	2	27%	1	9%	T1,T2	CS,D
Ireland	48	22	23	0.2%	-25	-52%	2	7%	M,T3	CS
Italy	1 493	2 485	2 359	18.1%	866	58%	-126	-5%	T1,T2	CS
Latvia	0	4	3	0.0%	3	3985%	-2	-40%	T1	D
Lithuania	8	2	2	0.0%	-6	-74%	0	25%	T1	CS
Luxembourg	0	1	0	0.0%	0	114%	0	-14%	NA,T1	D,NA
Malta	1	0	0	0.0%	-1	-80%	0	-21%	T1	D
Netherlands	84	32	29	0.2%	-55	-65%	-3	-9%	T1	CS,D
Poland	63	128	145	1.1%	81	129%	17	13%	T1	D
Portugal	178	477	511	3.9%	333	187%	34	7%	T1,T3	D,OTH
Romania	25	210	117	0.9%	92	371%	-93	-44%	T1,T2	D,OTH
Slovakia	4	1	2	0.0%	-2	-58%	0	5%	T2	D
Slovenia	1	2	1	0.0%	0	11%	0	-29%	T1	D
Spain	1 655	3 028	3 270	25.1%	1 615	98%	242	8%	T3	D
Sweden	683	323	349	2.7%	-333	-49%	26	8%	T1	D
EU-27	**11 267**	**13 079**	**13 054**	**100%**	**1 786**	**16%**	**-25**	**0%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

1A3a Domestic Aviation – Jet Kerosene (CO_2)

CO_2 emissions from jet kerosene accounted for 98.3 % of total GHG emissions from domestic aviation in 2023.

Table 3.58 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for domestic aviation – jet kerosene. Between 1990 and 2023, CO_2 emissions increased by 20% in the EU, while between 2022 and 2023 the corresponding change was 0.1 % decrease. Top three countries in 2023 were France, Spain, and Italy, which accounted for the 77 % of the EU value.

Table 3.58 1A3a Domestic Aviation – Jet Kerosene: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	31	24	25	0.2%	-6	-18%	1	3%	T3	D
Belgium	12	6	7	0.1%	-5	-39%	1	12%	T1	D
Bulgaria	28	16	17	0.1%	-11	-39%	1	8%	T3	CR
Croatia	6	25	29	0.2%	22	355%	4	17%	T1	D
Cyprus	26	1	1	0.0%	-25	-96%	0	-6%	T3	M
Czechia	IE	6	6	0.0%	6	∞	0	0%	T1,T2	M
Denmark	207	117	122	0.9%	-85	-41%	4	4%	T2	CS
Estonia	6	5	6	0.0%	0	0%	1	14%	T2	D
Finland	377	135	133	1.0%	-244	-65%	-3	-2%	T2	CS
France	3,530	4,534	4,331	33.5%	801	23%	-203	-4%	T3	D
Germany	2,161	1,019	1,075	8.3%	-1,086	-50%	56	5%	CS,T2	CS,M
Greece	311	385	409	3.2%	98	31%	25	6%	T3	D
Hungary	3	4	4	0.0%	1	52%	1	16%	T2	CS
Ireland	45	20	21	0.2%	-24	-53%	2	8%	M,T3	CS
Italy	1,459	2,479	2,355	18.2%	896	61%	-124	-5%	T1,T2	CS
Latvia	0	4	2	0.0%	2	3833%	-1	-40%	T1	D
Lithuania	7	1	1	0.0%	-7	-92%	0	15%	T1	CS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	1	0	0	0.0%	-1	-87%	0	-28%	T1	D
Netherlands	73	28	25	0.2%	-48	-66%	-3	-12%	T1	D
Poland	38	116	138	1.1%	100	261%	22	19%	T1	D
Portugal	176	475	509	3.9%	333	189%	34	7%	T1,T3	D,OTH
Romania	25	207	114	0.9%	89	358%	-94	-45%	T2	OTH
Slovakia	4	1	1	0.0%	-2	-60%	0	5%	T2	D
Slovenia	NO	0	0	0.0%	0	∞	0	5%	T1	D
Spain	1,628	3,017	3,258	25.2%	1,630	100%	241	8%	T3	D
Sweden	668	321	347	2.7%	-321	-48%	26	8%	T1	D
EU-27	**10,822**	**12,947**	**12,937**	**100%**	**2,115**	**20%**	**-10**	**0%**	-	-

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

Figure 3.92 shows the time series of CO_2 emissions in EU from domestic aviation – jet kerosene and the highest shares of countries. Figure 3.93 1A3a Domestic Aviation - Jet Kerosene: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 72.7 t/TJ.

Figure 3.92 1A3a Domestic Aviation – Jet Kerosene: Time series of CO_2 emissions in EU and highest shares of countries

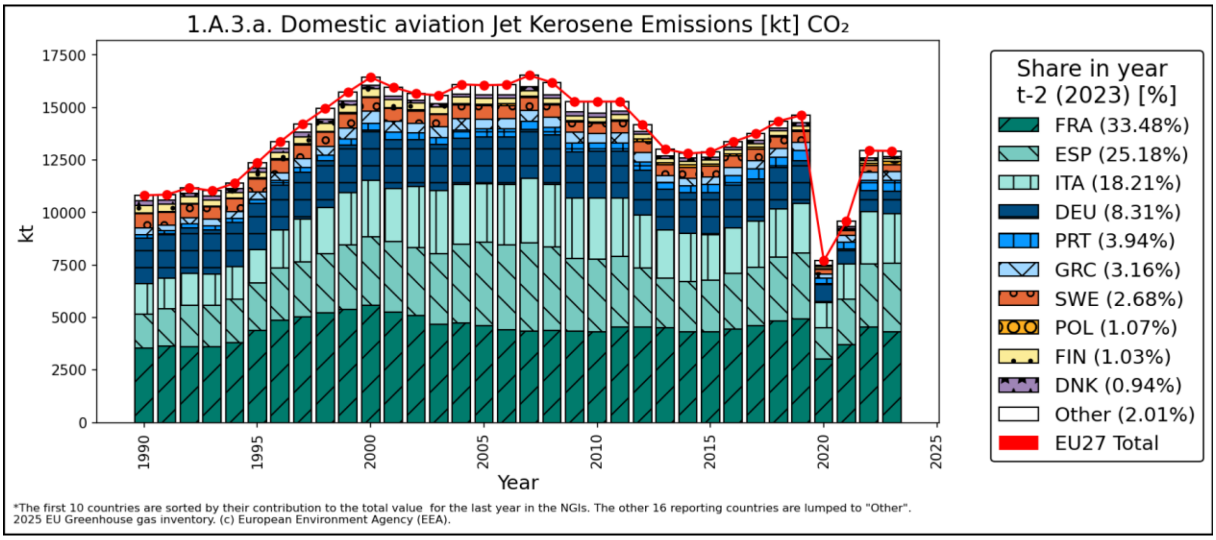
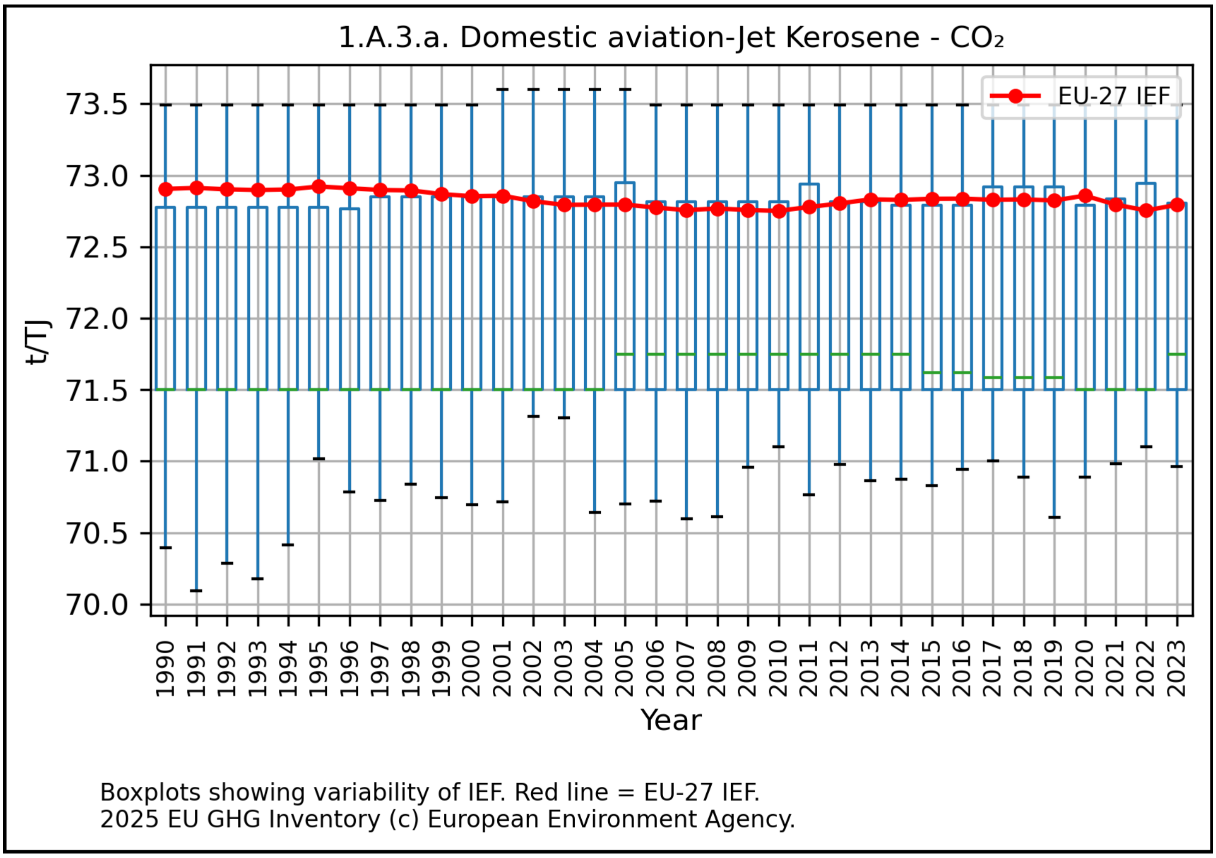


Figure 3.93 1A3a Domestic Aviation - Jet Kerosene: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



3.6.3.2 Road Transportation (1A3b) (EU)

The mobile source category 1A3b Road transportation includes all types of light and heavy duty vehicles, i.e. passenger cars, light commercial vehicles, lorries, tractors, trailers and semi-trailers, and buses; in addition, all types of two and three-wheelers, i.e. mopeds and motorcycles (including tricycles). All these vehicles operate on various liquid and gaseous fuel types.

CO_2 emissions from 1A3b Road Transportation

CO_2 emissions from road transport is one of the largest key source categories among all sources in the EU accounting for 24.7 % of total GHG emissions in 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only road transport, CO_2 accounted for 98.94 % of total GHG emissions from road transport in EU, 2023.

The time series of CO_2 emissions and activity data from 1A3b Road transportation, years 1990-2023, are shown in Figure 3.94. From this figure it can be observed that the largest contribution to emissions comes from the usage of diesel oil and gasoline.

Figure 3.94 1A3b Road Transportation: CO_2 emissions (in Mt) and activity data (in TJ)

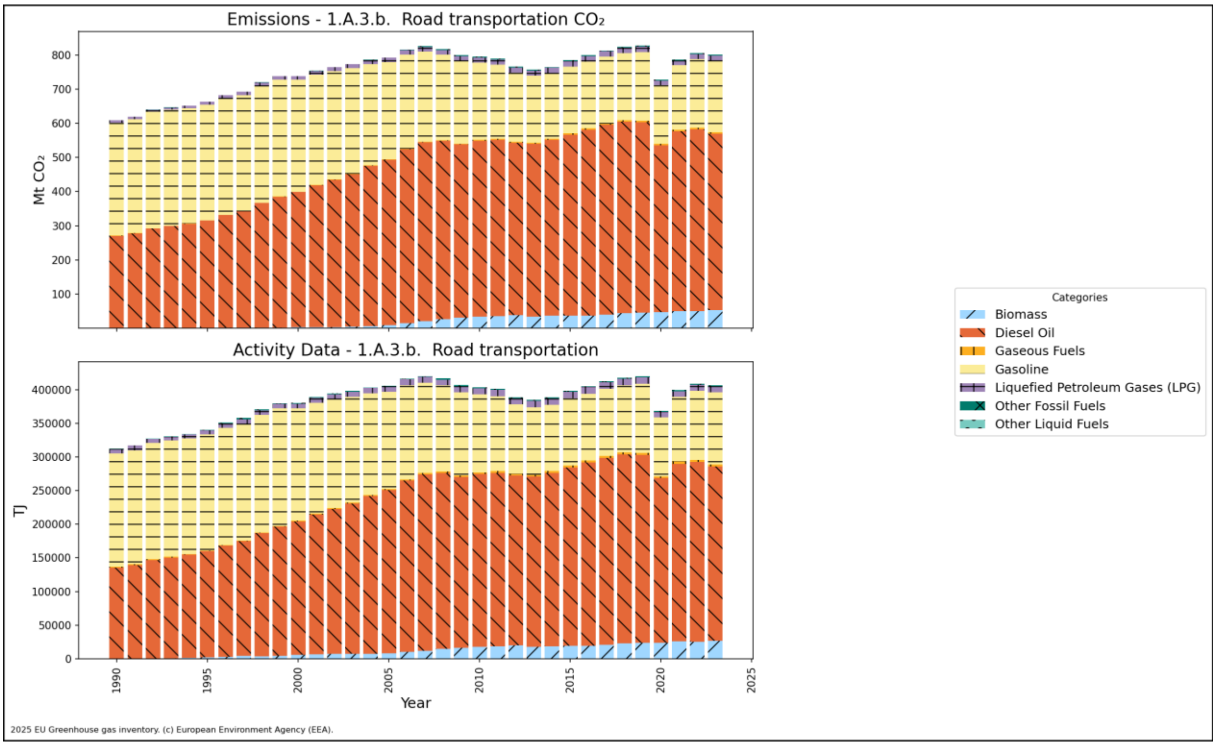


Table 3.59 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation. Between 1990 and 2023, CO_2 emissions increased by 23 % in the EU, while between 2022 and 2023 the corresponding change was 1% decrease. Top three countries in 2023 were Germany, France, and Italy, which accounted for the 47 % of the EU value.

Table 3.59 1A3b Road Transportation: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	13 280	20 176	19 388	2.6%	6 108	46%	-789	-4%	NA,T2	CS,D,NA
Belgium	19 677	23 021	23 469	3.1%	3 792	19%	448	2%	M,NA,T2	CS,M,NA
Bulgaria	5 784	9 585	9 776	1.3%	3 992	69%	191	2%	NA,T1,T2	CR,D,NA
Croatia	3 506	6 442	7 288	1.0%	3 782	108%	846	13%	NA,T1	D,NA
Cyprus	1 191	1 974	2 139	0.3%	948	80%	165	8%	NA,T1,T2	D,M,NA
Czechia	10 252	18 914	19 439	2.6%	9 187	90%	524	3%	NA,T2	M,NA
Denmark	9 337	11 063	10 965	1.5%	1 629	17%	-97	-1%	NA,T2	CR,CS,D,NA
Estonia	2 235	2 348	2 342	0.3%	107	5%	-6	0%	NA,T2	CS,NA
Finland	10 804	9 200	8 852	1.2%	-1 952	-18%	-348	-4%	NA,T2	CS,NA
France	114 051	120 365	115 656	15.4%	1 605	1%	-4 710	-4%	NA,T3	CS,D,M,NA
Germany	151 890	142 889	140 313	18.7%	-11 577	-8%	-2 576	-2%	CS,NA,T2,T3	CS,M,NA
Greece	11 793	15 213	14 754	2.0%	2 961	25%	-459	-3%	NA,T1,T2,T3	CS,D,NA
Hungary	7 851	14 714	13 650	1.8%	5 799	74%	-1 064	-7%	NA,T1,T2	CS,D,NA
Ireland	4 690	11 029	11 078	1.5%	6 388	136%	49	0%	CS,NA,T2,T3	CS,M,NA
Italy	92 332	99 434	99 907	13.3%	7 575	8%	473	0%	NA,T2	CS,M,NA
Latvia	2 402	3 006	3 023	0.4%	620	26%	17	1%	NA,T1,T2	CS,D,NA
Lithuania	5 247	5 804	5 934	0.8%	687	13%	130	2%	NA,T1,T2	CS,D,NA
Luxembourg	2 572	4 164	4 012	0.5%	1 440	56%	-151	-4%	NA,T1,T2	CS,D,NA
Malta	333	661	681	0.1%	348	104%	20	3%	NA,T1	D,NA
Netherlands	26 410	24 073	25 070	3.3%	-1 339	-5%	997	4%	NA,T1,T2	CS,NA
Poland	18 478	67 894	67 116	9.0%	48 638	263%	-778	-1%	NA,T1,T2	D,NA
Portugal	10 000	16 166	17 241	2.3%	7 240	72%	1 075	7%	T1	OTH
Romania	10 366	20 185	21 234	2.8%	10 868	105%	1 049	5%	NA,T3	NA,OTH
Slovakia	4 503	7 584	7 539	1.0%	3 036	67%	-45	-1%	NA,T2	CS,D,NA
Slovenia	2 607	5 709	5 285	0.7%	2 678	103%	-424	-7%	M,NA	M,NA
Spain	50 429	82 598	80 353	10.7%	29 924	59%	-2 245	-3%	CR,NA	CR,CS,NA
Sweden	17 744	12 705	12 588	1.7%	-5 156	-29%	-117	-1%	T2	CS
EU-27	**609 764**	**756 914**	**749 090**	**100%**	**139 325**	**23%**	**-7 825**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

Table 3.60 shows the share of different fuels in total EU fuel consumption for road transport in 2023. Diesel oil has the largest percentage with 64.6 %, followed by gasoline with 26.1%, biomass 6.6 %, LPG 1.9 %, gaseous fuels 0.5 %, and other fossil fuels 0.3 %.

Table 3.60 1A3b Road Transportation: Share of different fuels in total EU consumption (2023)

Diesel oil	Gasoline	Biomass	Liquefied petroleum gases (LPG)	Gaseous fuels	Other fossil
64.6 %	26.1 %	6.6 %	1.9 %	0.5%	0.3 %

1A3b Road Transportation – Diesel Oil (CO_2)

CO_2 emissions from diesel oil accounted for 68.3 % of total GHG emissions from road transport in 2023. Table 3.61 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – diesel oil. Between 1990 and 2023, CO_2 emissions increased by 91 % in the EU, while between 2022 and 2023 the corresponding change was 3 % decrease. Top three countries in 2023 were Germany, France, and Italy, which accounted for the 47 % of the EU value.

Table 3.61: 1A3b Road Transportation – Diesel Oil: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	5 358	15 685	14 667	2.8%	9 309	174%	-1 018	-6%
Belgium	11 027	16 376	16 260	3.1%	5 233	47%	-116	-1%
Bulgaria	1 539	6 620	6 792	1.3%	5 253	341%	171	3%
Croatia	1 159	4 859	5 547	1.1%	4 388	379%	688	14%
Cyprus	671	985	1 113	0.2%	442	66%	128	13%
Czechia	6 655	13 860	14 080	2.7%	7 425	112%	220	2%
Denmark	4 417	7 450	7 316	1.4%	2 900	66%	-134	-2%
Estonia	693	1 682	1 688	0.3%	995	144%	6	0%
Finland	4 923	5 993	5 639	1.1%	715	15%	-355	-6%
France	54 621	91 429	85 152	16.5%	30 530	56%	-6 277	-7%
Germany	54 478	92 397	88 532	17.1%	34 054	63%	-3 865	-4%
Greece	4 264	8 100	7 687	1.5%	3 423	80%	-413	-5%
Hungary	2 388	10 226	9 253	1.8%	6 864	287%	-973	-10%
Ireland	1 914	8 948	8 854	1.7%	6 940	363%	-94	-1%
Italy	47 808	68 668	68 309	13.2%	20 501	43%	-359	-1%
Latvia	623	2 476	2 484	0.5%	1 861	299%	8	0%
Lithuania	2 134	4 739	4 778	0.9%	2 644	124%	39	1%
Luxembourg	1 286	3 173	2 918	0.6%	1 632	127%	-255	-8%
Malta	150	414	424	0.1%	274	183%	10	2%
Netherlands	13 008	12 668	12 389	2.4%	-620	-5%	-279	-2%
Poland	8 769	47 092	45 498	8.8%	36 729	419%	-1 594	-3%
Portugal	5 625	12 646	13 325	2.6%	7 700	137%	679	5%
Romania	3 648	15 921	16 800	3.2%	13 151	360%	879	6%
Slovakia	3 123	5 780	5 594	1.1%	2 471	79%	-186	-3%
Slovenia	867	4 395	3 888	0.8%	3 022	349%	-507	-12%
Spain	24 706	64 082	60 888	11.8%	36 182	146%	-3 193	-5%
Sweden	4 812	7 409	7 441	1.4%	2 629	55%	32	0%
EU-27	**270 666**	**534 074**	**517 316**	**100%**	**246 650**	**91%**	**-16 758**	**-3%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.95 shows the time series of CO_2 emissions in EU from road transport – diesel oil and the highest shares of countries. Figure 3.96 1A3b Road Transportation – Diesel Oil: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 74 t/TJ.

Figure 3.95 1A3b Road Transportation - Diesel Oil: Time series of CO_2 emissions in EU and highest shares of countries

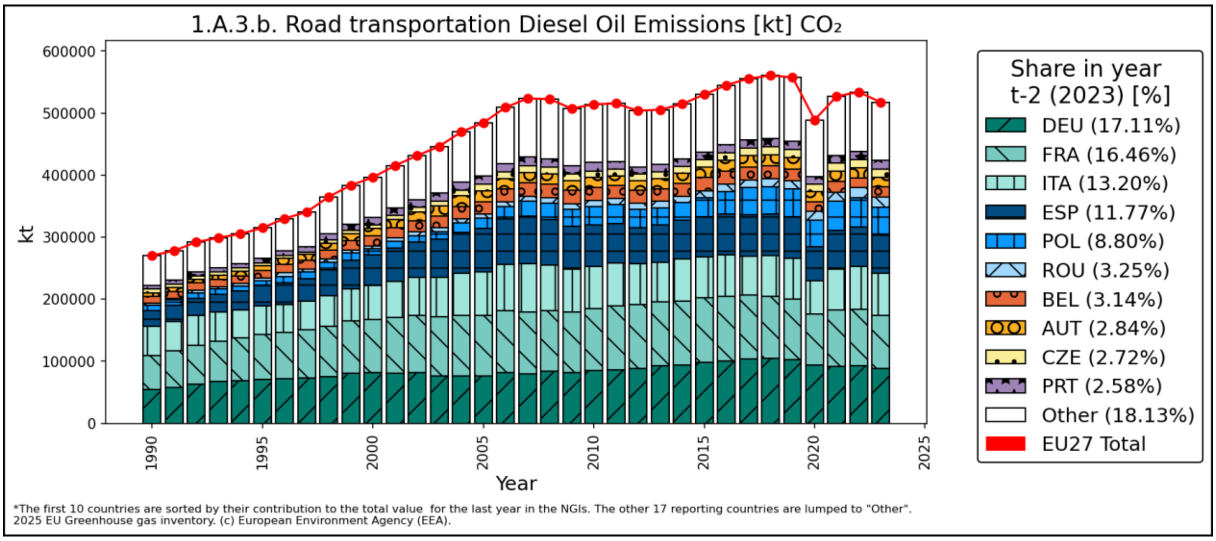
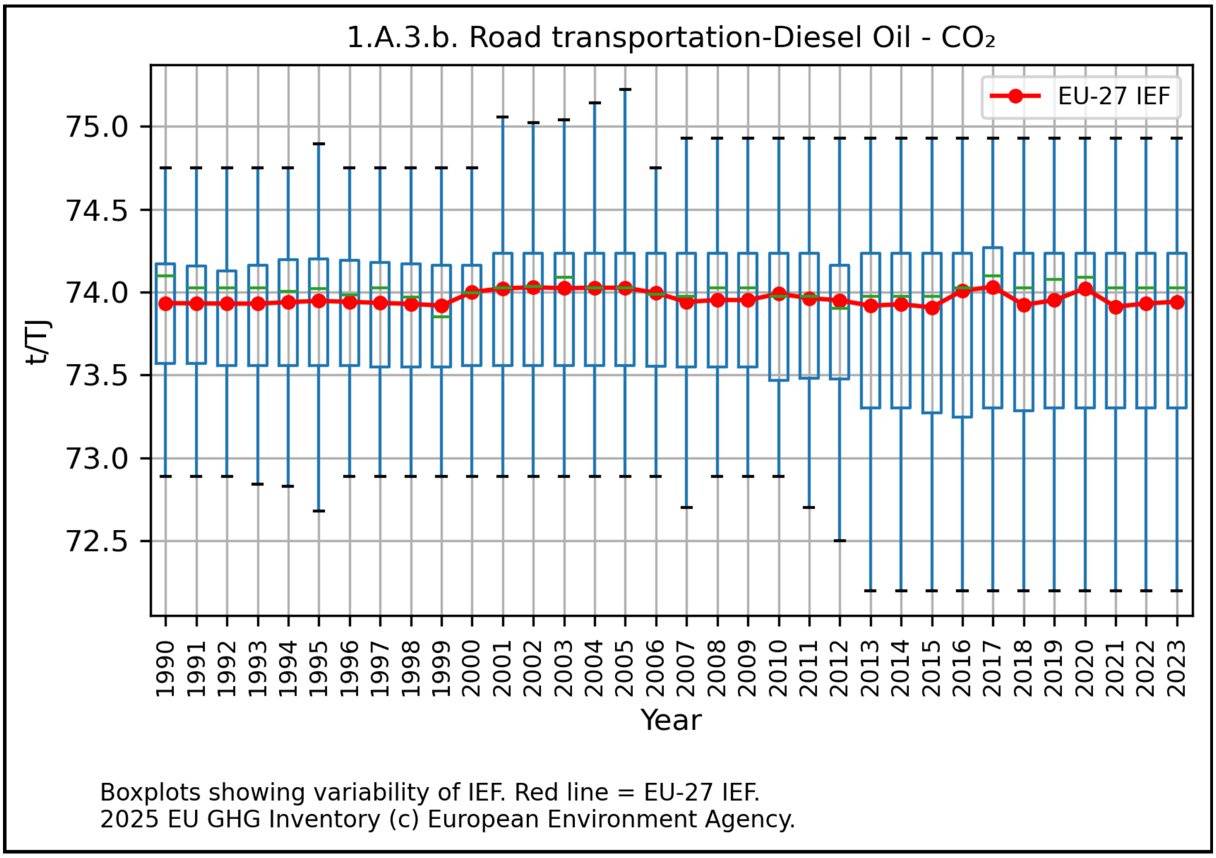


Figure 3.96 1A3b Road Transportation – Diesel Oil: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



1A3b Road Transportation – Gasoline (CO_2)

CO_2 emissions from gasoline accounted for 27.7 % of total GHG emissions from road transport in 2023. Table 3.9 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – gasoline. Between 1990 and 2023, CO_2 emissions decreased by 37 % in the EU, while between 2022 and 2023 the corresponding change was 5 % increase. Top three countries in 2023 were Germany, France, and Italy, which accounted for the 50 % of the EU value.

Table 3.9 1A3b Road Transportation – Gasoline: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	7 896	4 389	4 625	2.2%	-3 270	-41%	236	5%
Belgium	8 479	6 223	6 769	3.2%	-1 710	-20%	546	9%
Bulgaria	4 241	1 577	1 561	0.7%	-2 680	-63%	-16	-1%
Croatia	2 347	1 434	1 609	0.8%	-738	-31%	175	12%
Cyprus	519	982	1 020	0.5%	501	96%	38	4%
Czechia	3 597	4 595	4 888	2.3%	1 291	36%	293	6%
Denmark	4 910	3 568	3 610	1.7%	-1 301	-26%	42	1%
Estonia	1 542	614	608	0.3%	-933	-61%	-6	-1%
Finland	5 880	3 162	3 161	1.5%	-2 720	-46%	-1	0%
France	59 268	26 738	28 463	13.6%	-30 805	-52%	1 724	6%
Germany	97 217	48 785	50 361	24.0%	-46 856	-48%	1 576	3%
Greece	7 438	6 391	6 332	3.0%	-1 106	-15%	-58	-1%
Hungary	5 429	4 395	4 295	2.0%	-1 134	-21%	-101	-2%
Ireland	2 758	2 042	2 176	1.0%	-582	-21%	134	7%
Italy	39 949	24 615	25 547	12.2%	-14 402	-36%	932	4%
Latvia	1 722	425	441	0.2%	-1 281	-74%	17	4%
Lithuania	3 053	770	855	0.4%	-2 198	-72%	85	11%
Luxembourg	1 275	978	1 080	0.5%	-195	-15%	102	10%
Malta	183	244	254	0.1%	71	39%	10	4%
Netherlands	10 661	10 870	12 180	5.8%	1 519	14%	1 310	12%
Poland	9 709	14 999	15 738	7.5%	6 028	62%	739	5%
Portugal	4 369	3 294	3 660	1.7%	-709	-16%	366	11%
Romania	6 591	4 030	4 204	2.0%	-2 387	-36%	173	4%
Slovakia	1 380	1 646	1 797	0.9%	417	30%	151	9%
Slovenia	1 740	1 260	1 342	0.6%	-398	-23%	82	6%
Spain	25 639	17 426	18 267	8.7%	-7 371	-29%	841	5%
Sweden	12 929	5 238	5 065	2.4%	-7 863	-61%	-173	-3%
EU-27	**330 722**	**200 690**	**209 908**	**100%**	**-120 814**	**-37%**	**9 218**	**5%**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.97 shows the time series of CO_2 emissions in EU from road transport – gasoline and the highest shares of countries. Figure 3.98 shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 72.8 t/TJ.

Figure 3.97 1A3b Road Transportation – Gasoline: Time series of CO_2 emissions in EU and highest shares of countries

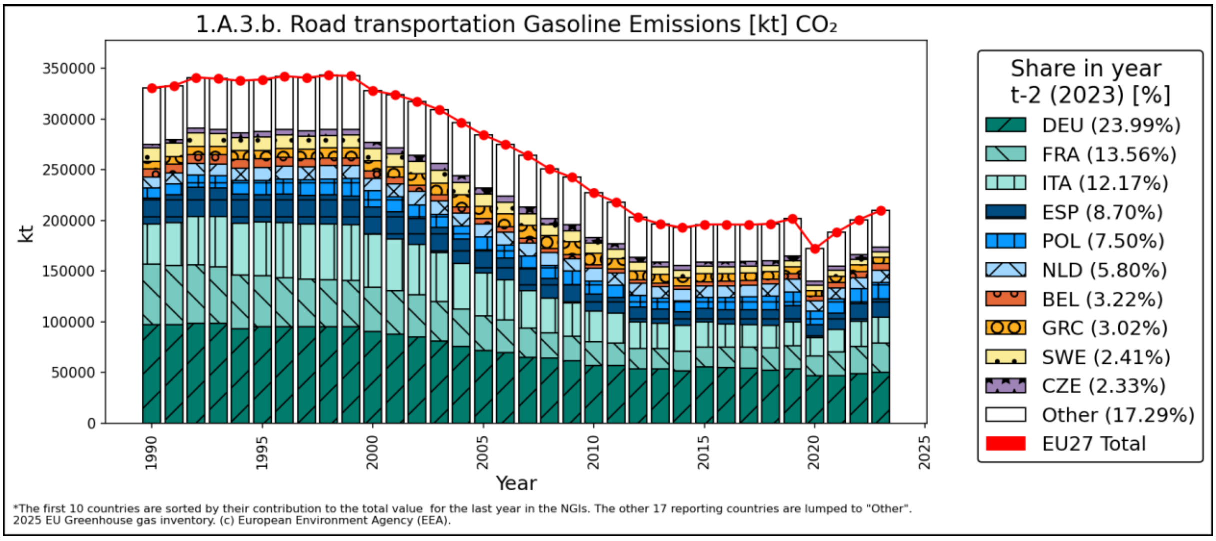
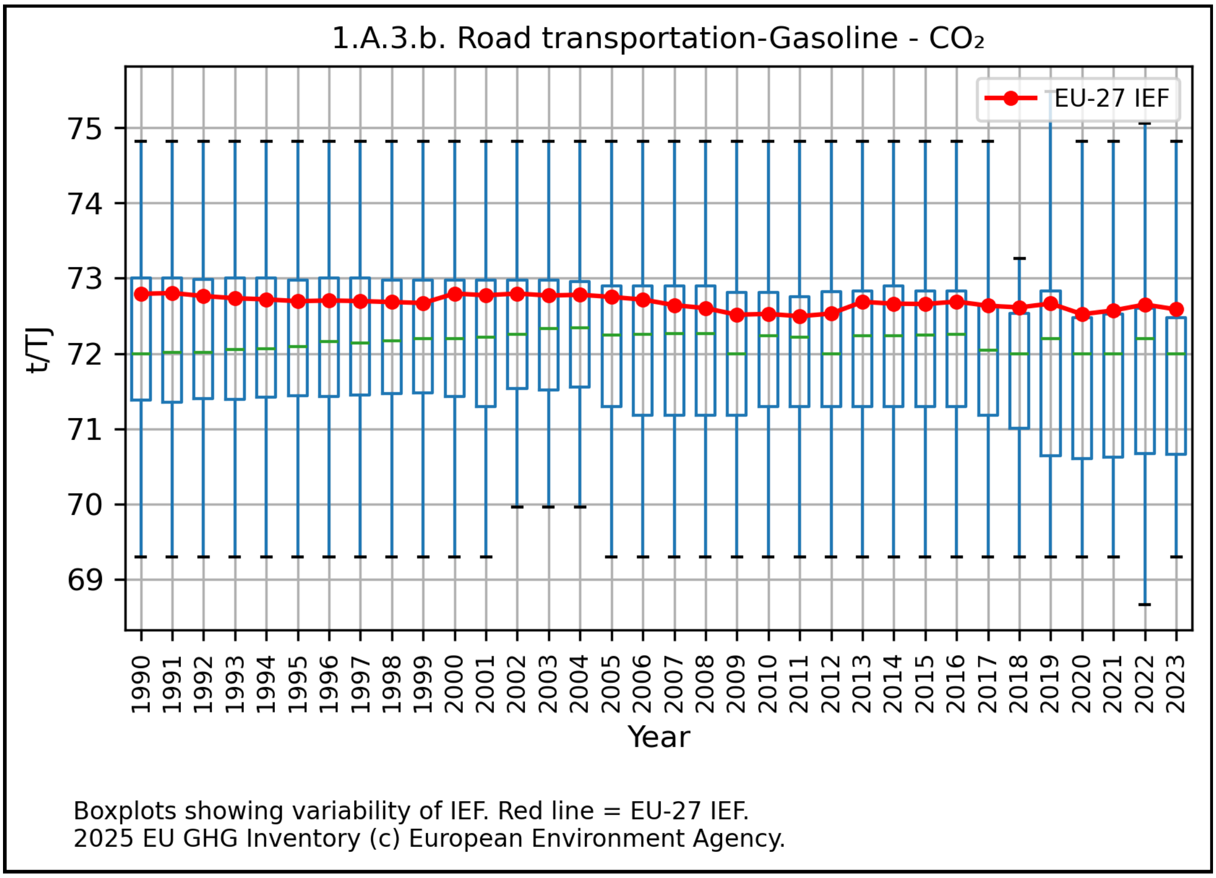


Figure 3.98 1A3b Road Transportation – Gasoline: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



1A3b Road Transportation – LPG (CO_2)

CO_2 emissions from LPG accounted for 2 % of total GHG emissions from road transport in 2023. *Table 3.62* shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – LPG. Between 1990 and 2023, CO_2 emissions increased by 103 % in the EU, while between 2022 and 2023 the corresponding change was 0.3 % decrease. Top three countries in 2023 were Poland, Italy, and Bulgaria, which accounted for the 77 % of the EU value.

Table 3.62: 1A3b Road Transportation – LPG: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	26	8	5	0.0%	-21	-81%	-3	-35%
Belgium	169	129	137	0.9%	-32	-19%	8	6%
Bulgaria	NO	1 209	1 267	8.4%	1 267	∞	58	5%
Croatia	NO	137	125	0.8%	125	∞	-12	-9%
Cyprus	NO	3	3	0.0%	3	∞	0	-15%
Czechia	NO	257	269	1.8%	269	∞	12	5%
Denmark	10	0	0	0.0%	-10	-100%	0	66%
Estonia	1	29	22	0.1%	21	3617%	-7	-24%
Finland	NA,NO	NA,NO	NA,NO	-	-	-	-	-
France	150	251	309	2.0%	159	106%	58	23%
Germany	9	780	526	3.5%	517	5712%	-254	-33%
Greece	91	525	531	3.5%	441	486%	6	1%
Hungary	NO	38	41	0.3%	41	∞	3	8%
Ireland	19	4	3	0.0%	-15	-83%	-1	-28%
Italy	4 026	4 646	4 697	31.1%	671	17%	52	1%
Latvia	37	95	86	0.6%	49	131%	-9	-9%
Lithuania	60	259	262	1.7%	202	335%	3	1%
Luxembourg	11	1	1	0.0%	-10	-91%	0	41%
Malta	NA,NO	2	2	0.0%	2	∞	0	6%
Netherlands	2 740	347	331	2.2%	-2 409	-88%	-16	-5%
Poland	IE,NO	5 615	5 645	37.4%	5 645	∞	30	1%
Portugal	0	105	127	0.8%	127	200493%	22	21%
Romania	NO	234	231	1.5%	231	∞	-3	-1%
Slovakia	NO	113	114	0.8%	114	∞	0	0%
Slovenia	NO	30	28	0.2%	28	∞	-2	-6%
Spain	79	325	341	2.3%	263	335%	17	5%
Sweden	0	IE,NO	IE,NO	-	0	-100%	-	-
EU-27	**7 428**	**15 141**	**15 103**	**100%**	**7 675**	**103%**	**-38**	**0%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

1A3b Road Transportation – Gaseous Fuels (CO_2)

CO_2 emissions from gaseous fuels accounted for 0.5 % of total GHG emissions from road transport in 2023. *Table 3.63* shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – gaseous fuels. Between 1990 and 2023, CO_2 emissions increased by 710 % in the EU, while between 2022 and 2023 the corresponding change was 0.4 % increase. Top three countries in 2023 were Italy, France, and Spain, which accounted for the 64 % of the EU value.

Table 3.63: 1A3b Road Transportation – Gaseous Fuels: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	NO	40	36	0.9%	36	∞	-3	-9%
Belgium	0	151	154	3.8%	154	3605264%	3	2%
Bulgaria	NO	150	129	3.1%	129	∞	-22	-14%
Croatia	NO	9	7	0.2%	7	∞	-2	-20%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	NO	168	170	4.1%	170	∞	2	1%
Denmark	0	18	16	0.4%	16	80872%	-1	-7%
Estonia	NO	24	24	0.6%	24	∞	0	1%
Finland	NA,NO	45	52	1.3%	52	∞	8	17%
France	0	740	829	20.2%	829	232688%	90	12%
Germany	NO	436	388	9.4%	388	∞	-48	-11%
Greece	NO	65	65	1.6%	65	∞	0	0%
Hungary	0	18	23	0.6%	23	8117%	5	28%
Ireland	NO	2	1	0.0%	1	∞	0	-30%
Italy	487	1 281	1 145	27.9%	658	135%	-136	-11%
Latvia	17	5	6	0.2%	-11	-63%	1	30%
Lithuania	NO	23	26	0.6%	26	∞	3	13%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Netherlands	NA,NO	151	138	3.4%	138	∞	-13	-8%
Poland	NO	67	94	2.3%	94	∞	27	40%
Portugal	NO	78	82	2.0%	82	∞	3	4%
Romania	NO	0	0	0.0%	0	∞	0	24%
Slovakia	NO	20	19	0.5%	19	∞	-1	-6%
Slovenia	NO	12	12	0.3%	12	∞	1	6%
Spain	NO	577	661	16.1%	661	∞	84	15%
Sweden	3	15	34	0.8%	31	1063%	18	119%
EU-27	**508**	**4 092**	**4 110**	**100%**	**3 603**	**710%**	**18**	**0%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.99: 1A3b Road Transportation – Gaseous Fuels: Time series of CO2 emissions in EU and highest shares of countries shows the time series of CO_2 emissions in EU from road transport – gaseous fuels and the highest shares of countries. Figure 3.100 1A3b Road Transportation – Gaseous Fuels: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 56 - 57 t/TJ.

Figure 3.99: 1A3b Road Transportation – Gaseous Fuels: Time series of CO_2 emissions in EU and highest shares of countries

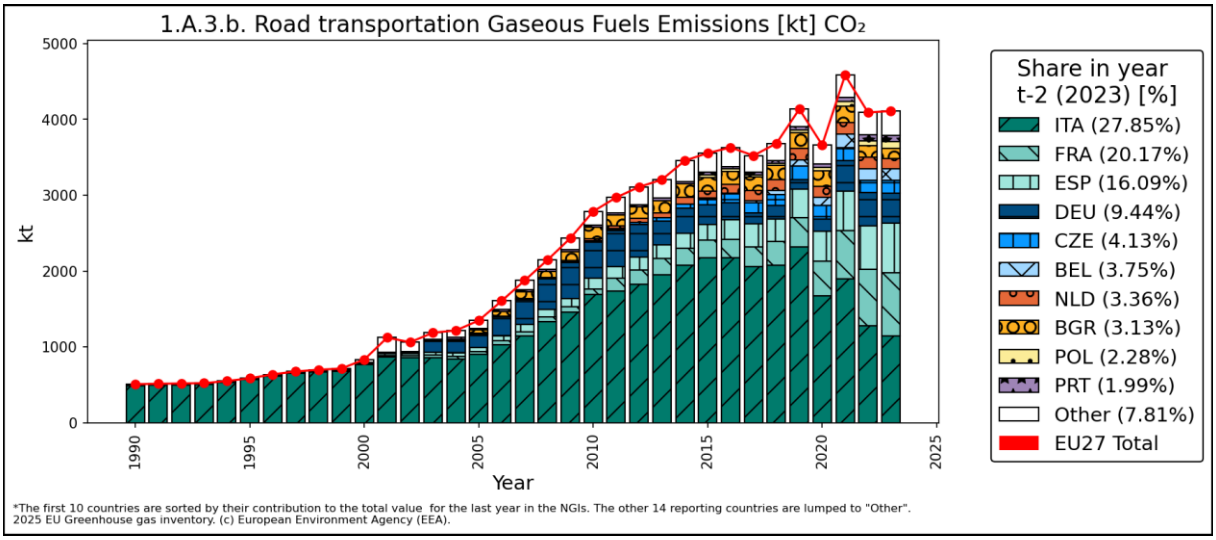
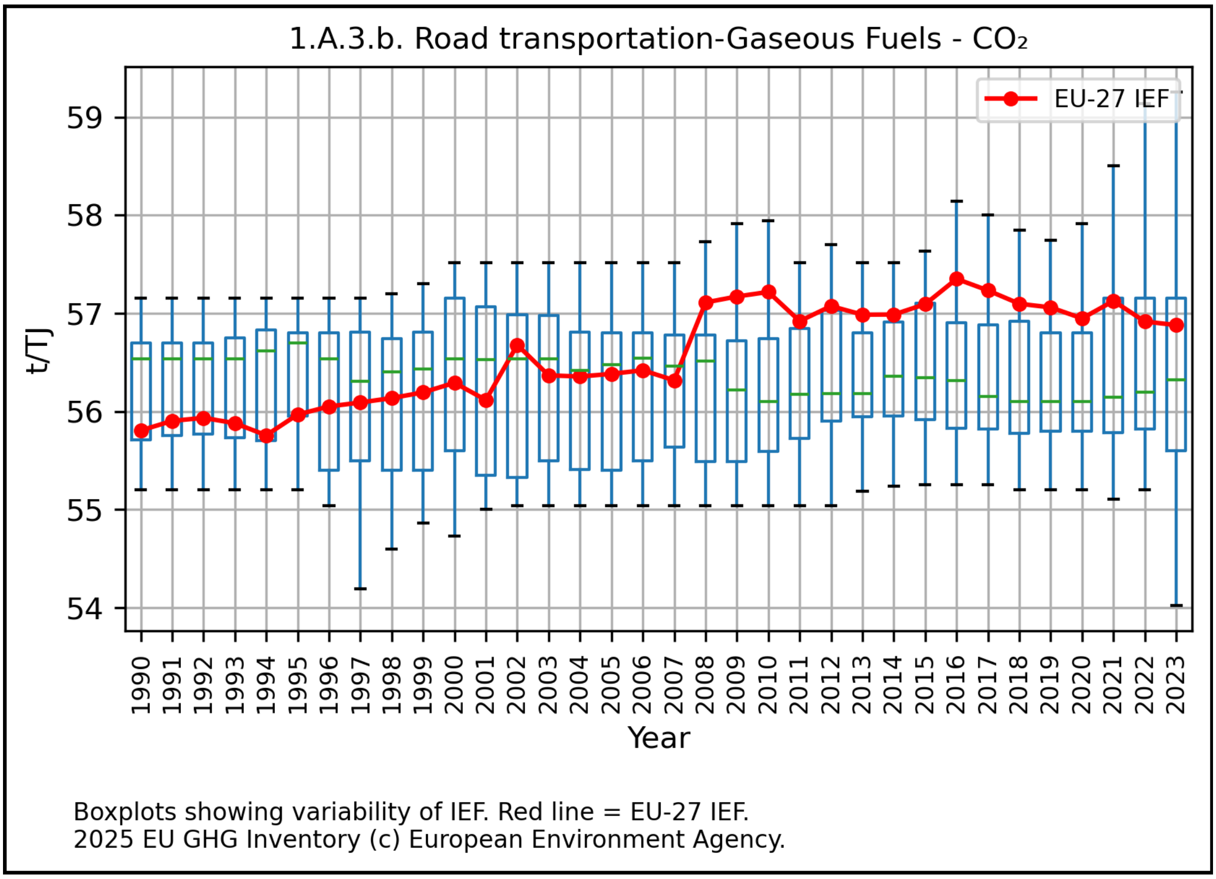


Figure 3.100 1A3b Road Transportation – Gaseous Fuels: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



1.A.3.b Road Transportation: Other Fossil Fuels (CO_2)

This category covers the CO_2 emissions from the fossil part of biofuels. According to the 2006 IPCC Guidelines (vol. 2, chapter 3, section 'CO_2 emissions from biofuels'. p. 3.17*): "… it is important to assess the biofuel origin so as to identify and separate fossil from biogenic feedstocks".* In other words, a part of the carbon of biofuels (and the associated CO_2 emissions) may have a fossil origin. The IPCC Guidelines provide some examples about biofuels' fossil part: *"… biodiesel made from coal methanol with animal feedstocks has a non-zero fossil fuel fraction and is therefore not fully carbon neutral. Ethanol from the fermentation of agricultural products will generally be purely biogenic (carbon neutral), except in some cases, such as fossil-fuel derived methanol. Products which have undergone further chemical transformation may contain substantial amounts of fossil carbon ranging from about 5-10 percent in the fossil methanol used for biodiesel production upwards to 46 percent in ethyl-tertiary-butyl-ether (ETBE) from fossil isobutene. Some processes may generate biogenic by-products such as glycol or glycerine, which may then be used elsewhere."*

Based on the above, all countries are encouraged to calculate these emissions and include them separately in the CRT tables under "Other fossil fuels". The contribution of this category to total GHG emissions from road transport was 0.3 % in 2023 (i.e. very small), hence, no further analysis is considered necessary.

CH_4 emissions from 1A3b Road Transportation

CH_4 emissions from road transport accounted only for 0.035 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only road transport, CH_4 accounted for 0.14 % of total GHG emissions from road transport in EU, 2023.

The time series of CH_4 emissions and activity data from 1A3b Road transportation, years 1990-2023, are shown in Figure 3.101. From this figure it can be observed that the largest contribution to emissions comes from the usage of gasoline.

Figure 3.101 1A3b Road Transportation: CH_4 emissions (in Mt of CO_2 equ.) and activity data (in TJ)

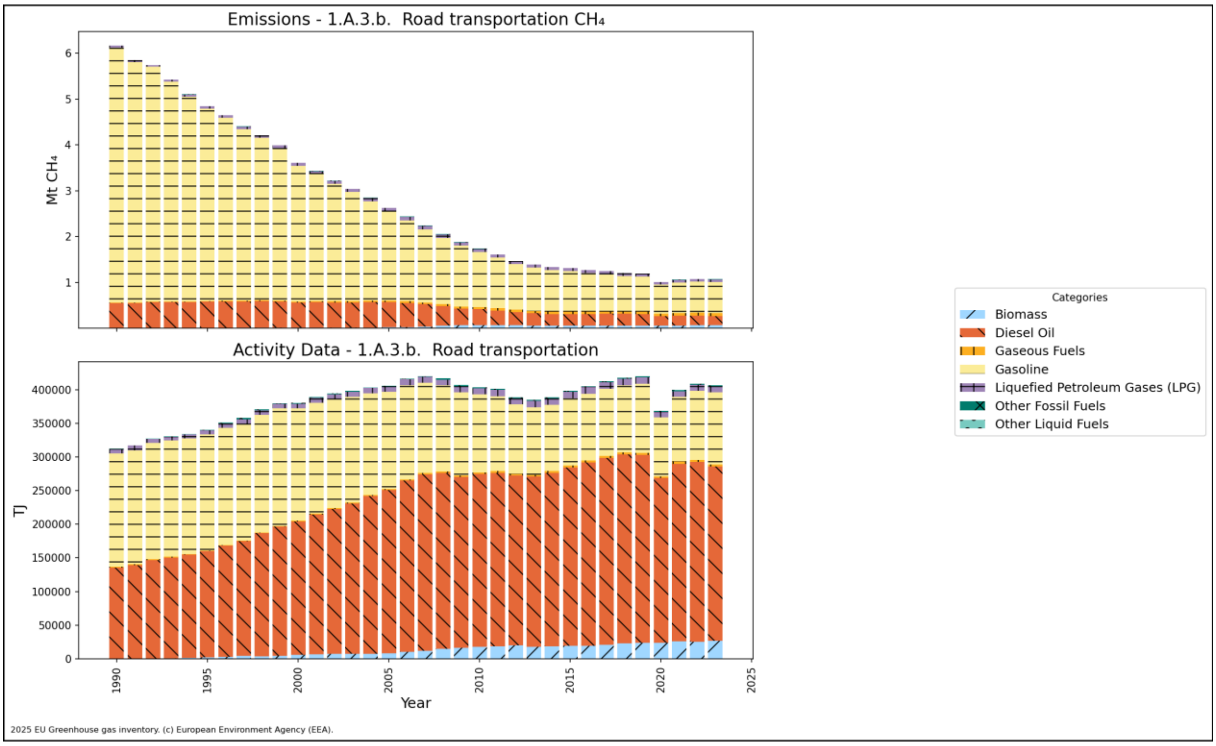


Table 3.64 shows the CH_4 emissions per country and at EU level (in kt of CO_2 equ.), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation. Between 1990 and 2023, CH_4 emissions decreased by 83 % in the EU, while between 2022 and 2023 the corresponding change was 1 % decrease. Top three countries in 2023 were Germany, Italy, and France, which accounted for the 48 % of the EU value.

Table 3.64 1A3b Road Transportation: CH_4 emissions per country (in kt of CO_2 equ.), share in EU (%), change, method and EF information

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	82	21	22	2.1%	-60	-73%	1	4%	NA,T3	CS,NA
Belgium	157	15	16	1.5%	-141	-90%	0	3%	M,NA,T3	CS,M,NA
Bulgaria	76	21	20	1.8%	-56	-74%	-1	-6%	NA,T2	CR,NA
Croatia	46	8	9	0.9%	-37	-80%	1	12%	NA,T1,T3	CR,D,NA
Cyprus	8	3	3	0.2%	-5	-68%	0	-7%	NA,T1,T2	D,M,NA
Czechia	93	24	25	2.3%	-69	-73%	1	2%	NA,T3	M,NA
Denmark	88	8	8	0.7%	-80	-91%	0	-1%	NA,T3	CR,NA
Estonia	24	3	2	0.2%	-22	-90%	0	-9%	NA,T3	CS,NA
Finland	120	8	8	0.7%	-112	-93%	0	-1%	NA,T3	CR,NA
France	1 112	137	137	12.8%	-975	-88%	0	0%	NA,T3	CS,M,NA
Germany	1 813	235	228	21.4%	-1 584	-87%	-7	-3%	CS,M,NA,T2,T3	CS,M,NA
Greece	120	65	61	5.8%	-58	-49%	-4	-6%	M,NA,T1,T2	D,M,NA
Hungary	75	21	19	1.8%	-56	-75%	-2	-8%	NA,T1,T3	D,M,NA
Ireland	55	9	9	0.9%	-45	-83%	1	6%	D,NA,T1,T3	D,M,NA
Italy	969	152	150	14.0%	-819	-85%	-2	-1%	NA,T3	M,NA
Latvia	23	3	3	0.3%	-20	-87%	0	-1%	NA,T1,T3	CR,D,M,NA
Lithuania	44	7	8	0.8%	-36	-82%	1	9%	NA,T1,T3	CR,D,NA
Luxembourg	14	3	3	0.3%	-10	-75%	0	1%	NA,T3	M,NA
Malta	3	1	1	0.1%	-2	-66%	0	-1%	NA,T3	M,NA
Netherlands	197	58	59	5.5%	-138	-70%	1	2%	NA,T1,T2,T3	CS,NA
Poland	153	78	78	7.3%	-75	-49%	0	0%	NA,T1,T3	D,NA
Portugal	109	20	20	1.9%	-89	-82%	0	2%	NO,T3	NO,OTH
Romania	101	37	37	3.4%	-65	-64%	-1	-2%	NA,T1,T3	D,NA,OTH
Slovakia	33	5	5	0.5%	-27	-84%	0	2%	NA,T3	D,NA
Slovenia	31	4	4	0.4%	-27	-87%	0	4%	M,NA	M,NA
Spain	446	105	110	10.3%	-336	-75%	5	4%	CR,NA	CR,NA
Sweden	178	24	23	2.2%	-155	-87%	-1	-3%	M,NA,T1,T2	CS,D,NA
EU-27	**6 170**	**1 076**	**1 068**	**100%**	**-5 101**	**-83%**	**-7**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

1A3b Road Transportation – Gasoline (CH_4)

CH_4 emissions from gasoline accounted for 0.10 % of total GHG emissions from road transport in 2023. Table 3.65 shows the CH_4 emissions per country and at EU level (in kt of CO_2 equ.), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – gasoline. Between 1990 and 2023, CH_4 emissions decreased by 88 % in the EU, while between 2022 and 2023 CH_4 emissions remained unchanged. Top three countries in 2023 were Germany, Italy, and France, which accounted for the 51 % of the EU value.

Table 3.65 1A3b Road Transportation – Gasoline: CH_4 emissions per country (in kt of CO_2 equ.), share in EU (%), change, method and EF information

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	77	7	7	1.1%	-70	-91%	0	0%
Belgium	130	10	10	1.5%	-119	-92%	0	5%
Bulgaria	71	7	7	1.0%	-65	-91%	-1	-7%
Croatia	43	5	6	1.0%	-37	-85%	1	27%
Cyprus	6	2	2	0.3%	-4	-67%	0	-7%
Czechia	73	16	16	2.4%	-56	-78%	1	4%
Denmark	77	6	6	0.9%	-71	-92%	0	-1%
Estonia	22	1	1	0.2%	-21	-94%	0	-4%
Finland	104	6	5	0.8%	-99	-95%	0	-5%
France	994	97	99	14.6%	-895	-90%	2	2%
Germany	1 762	149	142	21.0%	-1 620	-92%	-7	-5%
Greece	109	47	44	6.6%	-65	-59%	-3	-6%
Hungary	68	14	13	2.0%	-55	-80%	-1	-6%
Ireland	49	7	8	1.1%	-41	-84%	1	8%
Italy	821	105	104	15.4%	-717	-87%	-1	-1%
Latvia	20	1	1	0.2%	-19	-93%	0	3%
Lithuania	36	3	3	0.4%	-34	-92%	0	16%
Luxembourg	13	1	1	0.2%	-12	-92%	0	5%
Malta	2	1	1	0.1%	-2	-69%	0	0%
Netherlands	157	29	32	4.7%	-125	-80%	3	10%
Poland	132	34	36	5.3%	-97	-73%	2	5%
Portugal	94	12	13	1.9%	-82	-87%	1	5%
Romania	91	24	23	3.5%	-68	-74%	0	-1%
Slovakia	23	3	3	0.4%	-20	-88%	0	12%
Slovenia	28	3	3	0.4%	-25	-89%	0	7%
Spain	384	76	78	11.6%	-306	-80%	2	3%
Sweden	174	12	11	1.6%	-163	-94%	-1	-7%
EU-27	**5 563**	**678**	**678**	**100%**	**-4 885**	**-88%**	**0**	**0%**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period*
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.102 1A3b Road Transportation – Gasoline: Time series of CH4 emissions in EU and highest shares of countries shows the time series of CH_4 emissions in EU from road transport – gasoline and the highest shares of countries. Figure 3.103 1A3b Road Transportation – Gasoline: CH4 Implied Emission Factor (IEF) in EU (in kg/TJ) shows the CH_4 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CH_4 IEF at EU level decreases over time from 44 kg/TJ in 1990 to 10 kg/TJ in 2023.

Figure 3.102 1A3b Road Transportation – Gasoline: Time series of CH_4 emissions in EU and highest shares of countries

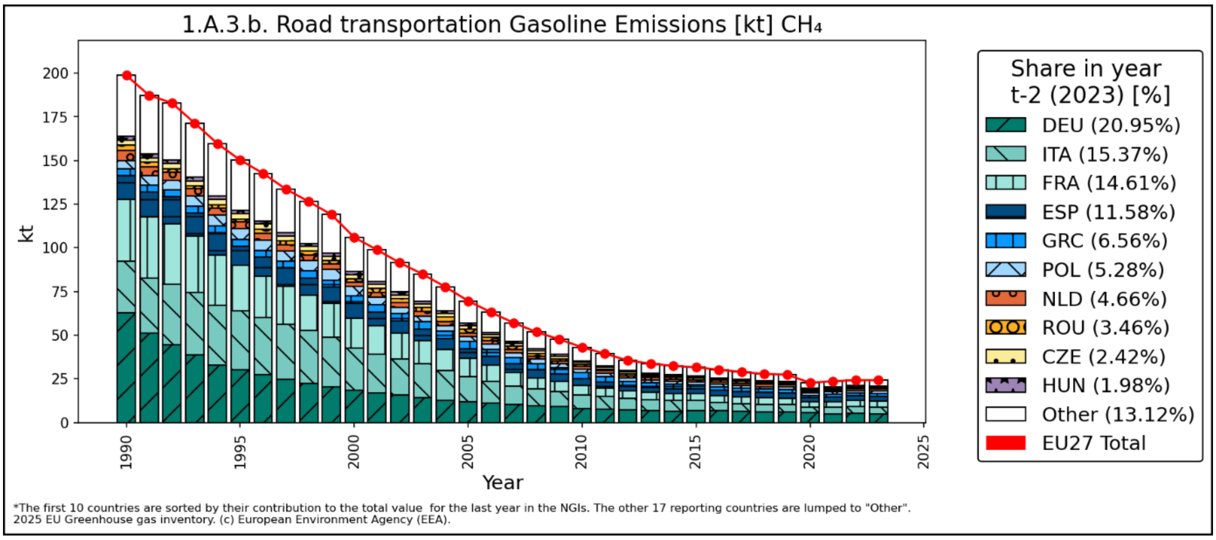
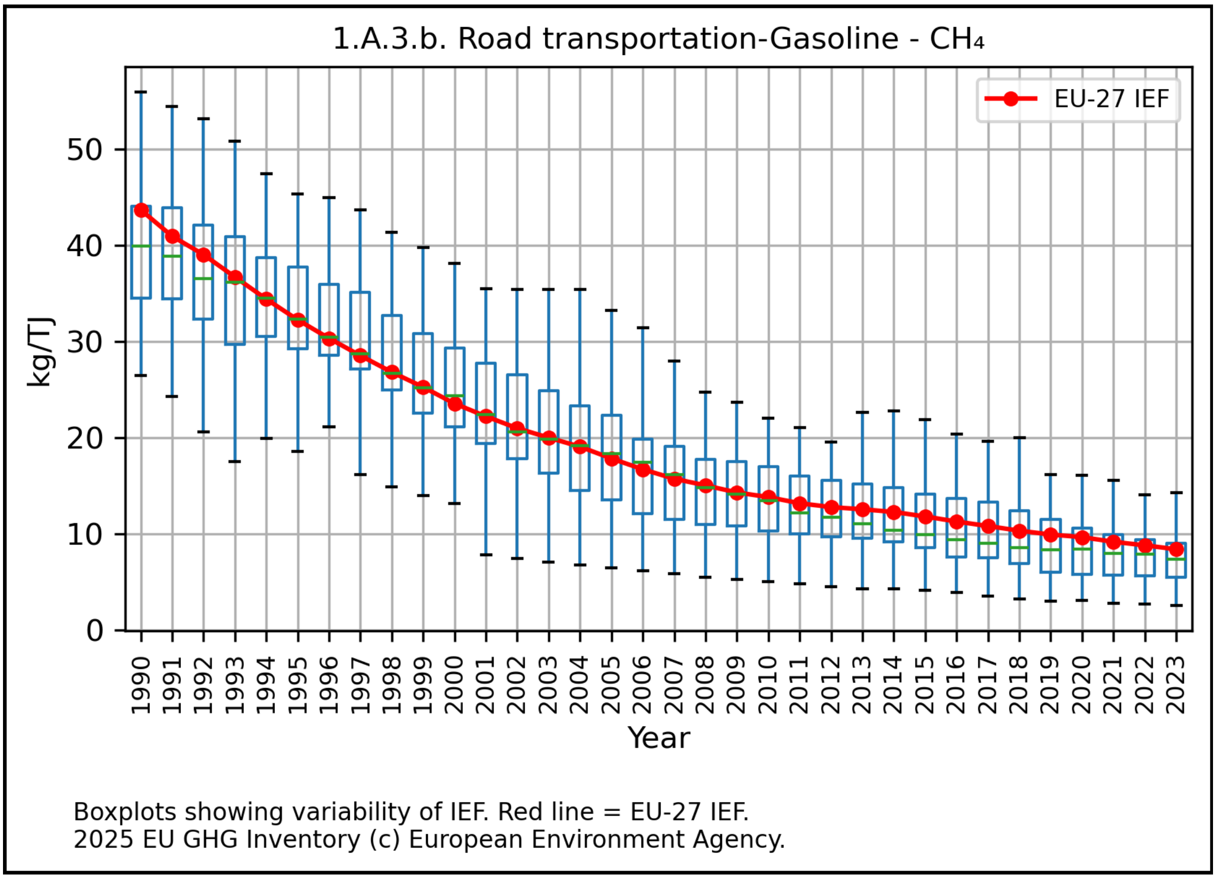


Figure 3.103 1A3b Road Transportation – Gasoline: CH_4 Implied Emission Factor (IEF) in EU (in kg/TJ)



N_2O emissions from 1A3b Road Transportation

N_2O emissions from road transport accounted only for 0.23 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only road transport, N_2O accounted for 0.92 % of total GHG emissions from road transport in EU, 2023.

The time series of N_2O emissions and activity data from 1A3b Road transportation, years 1990-2023, are shown in Figure 3.104. From this figure it can be observed that the largest contribution to emissions comes from the usage of diesel oil since 2006; for years prior to 2006 the higher contribution was coming from gasoline.

Figure 3.104 1A3b Road Transportation: N_2O emissions (in Mt of CO_2 equ.) and activity data (in TJ)

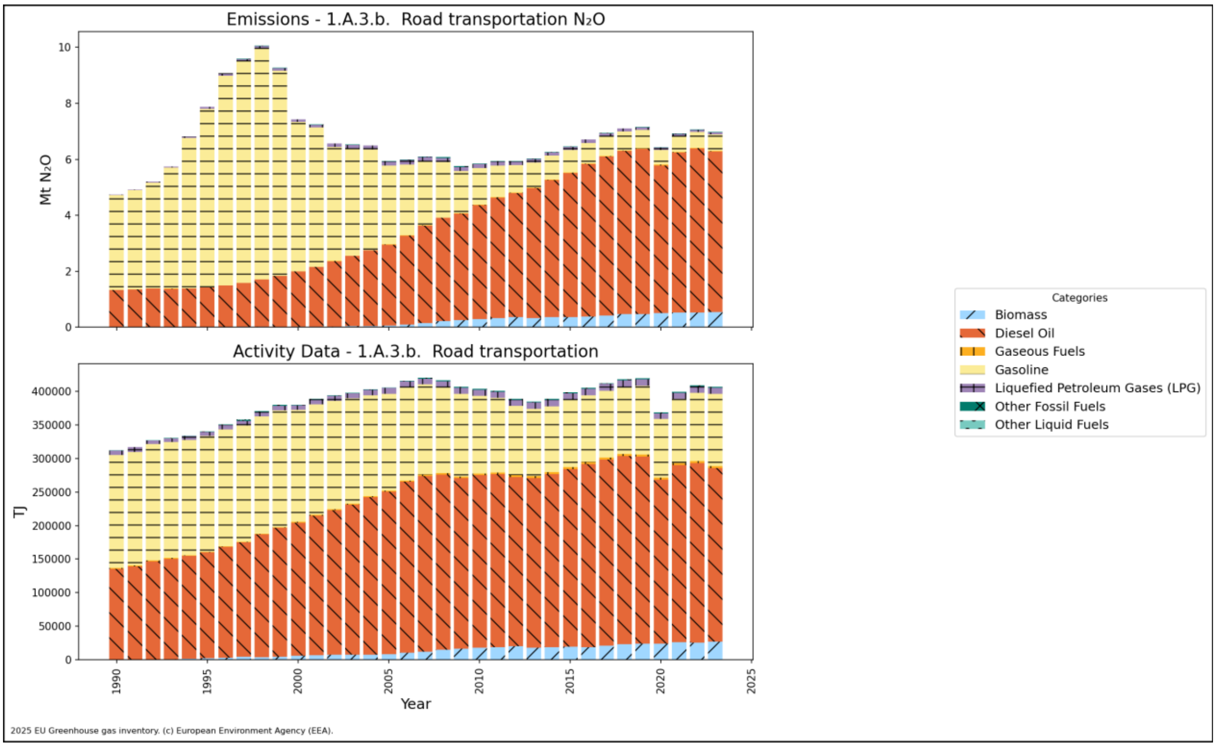


Table 3.66 shows the N_2O emissions per country and at EU level (in kt of CO_2 equ.), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation. Between 1990 and 2023, N_2O emissions increased by 47 % in the EU, while between 2022 and 2023 the corresponding change was 1 % decrease. Top three countries in 2023 were Germany, France, and Italy, which accounted for the 46 % of the EU value.

Table 3.66 1A3b Road Transportation: N_2O emissions per country (in kt of CO_2 equ.), share in EU (%), change, method and EF information

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023	Emissions in 2023	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	94	215	213	3.0%	119	126%	-3	-1%	NA,T3	CS,NA
Belgium	140	222	221	3.2%	80	57%	-1	-1%	M,NA,T3	CS,M,NA
Bulgaria	47	85	87	1.3%	40	84%	2	3%	NA,T2	CR,NA
Croatia	52	49	63	0.9%	10	20%	13	27%	NA,T1,T3	CR,D,NA
Cyprus	10	11	12	0.2%	2	18%	1	10%	NA,T1,T2	D,M,NA
Czechia	100	182	186	2.7%	86	87%	5	2%	NA,T3	M,NA
Denmark	78	110	109	1.6%	31	39%	-1	-1%	NA,T3	CR,NA
Estonia	19	21	21	0.3%	2	8%	0	-1%	NA,T3	CS,NA
Finland	137	71	69	1.0%	-68	-50%	-2	-2%	NA,T3	CR,NA
France	785	1 121	1 062	15.2%	278	35%	-59	-5%	NA,T3	CS,M,NA
Germany	1 123	1 355	1 321	18.9%	198	18%	-33	-2%	CS,M,NA,T2,T3	CS,M,NA
Greece	104	106	103	1.5%	-1	-1%	-3	-3%	M,NA,T1,T2	D,M,NA
Hungary	54	138	127	1.8%	73	135%	-11	-8%	NA,T1,T3	D,M,NA
Ireland	44	111	114	1.6%	70	161%	3	3%	NA,T3	M,NA
Italy	746	820	818	11.7%	72	10%	-2	0%	NA,T3	M,NA
Latvia	19	27	27	0.4%	9	47%	0	0%	NA,T1,T3	CR,D,M,NA
Lithuania	44	49	49	0.7%	5	12%	0	1%	NA,T1,T3	CR,D,NA
Luxembourg	14	43	41	0.6%	27	200%	-2	-4%	NA,T3	M,NA
Malta	2	4	4	0.1%	2	100%	0	2%	NA,T3	M,NA
Netherlands	89	279	293	4.2%	204	228%	14	5%	NA,T1,T2	CS,NA
Poland	136	623	617	8.8%	481	355%	-6	-1%	NA,T1,T3	D,NA
Portugal	70	137	144	2.1%	74	105%	7	5%	NO,T3	NO,OTH
Romania	202	213	221	3.2%	19	9%	7	3%	NA,T1,T3	D,NA,OTH
Slovakia	50	75	74	1.1%	24	47%	-1	-1%	NA,T3	D,NA
Slovenia	27	55	50	0.7%	23	88%	-5	-9%	M,NA	M,NA
Spain	413	786	778	11.1%	365	88%	-8	-1%	CR,NA	CR,NA
Sweden	138	161	156	2.2%	18	13%	-5	-3%	M,NA,T1,T2	CS,D,NA
EU-27	**4 738**	**7 070**	**6 981**	**100%**	**2 243**	**47%**	**-89**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

1A3b Road Transportation – Diesel Oil (N_2O)

N_2O emissions from diesel oil accounted for 0.76 % of total GHG emissions from road transport in 2023. Table 3.67 shows the N_2O emissions per country and at EU level (in kt of CO_2 equ.), share of each country in EU (%), change between years, method and EF information for 1A3b Road transportation – diesel oil. Between 1990 and 2023, N_2O emissions increased by 328 % in the EU, while between 2022 and 2023 the corresponding change was 2 % decrease. Top three countries in 2023 were Germany, France, and Spain, which accounted for the 48 % of the EU value.

Table 3.67 1A3b Road Transportation – Diesel Oil: N_2O emissions per country (in kt of CO_2 equ.), share in EU (%), change, method and EF information

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	11	195	191	3.3%	180	1680%	-5	-2%
Belgium	54	183	182	3.2%	127	234%	-1	-1%
Bulgaria	12	58	61	1.1%	50	429%	3	6%
Croatia	15	44	55	1.0%	40	262%	11	26%
Cyprus	3	8	9	0.2%	6	202%	1	16%
Czechia	64	152	156	2.7%	92	144%	4	3%
Denmark	27	95	95	1.7%	68	246%	0	0%
Estonia	6	19	19	0.3%	12	195%	0	1%
Finland	58	50	48	0.8%	-10	-17%	-2	-4%
France	189	947	879	15.4%	690	365%	-67	-7%
Germany	129	1 208	1 172	20.5%	1 042	807%	-37	-3%
Greece	35	60	58	1.0%	23	65%	-2	-4%
Hungary	19	111	101	1.8%	82	434%	-10	-9%
Ireland	12	99	100	1.7%	87	700%	1	1%
Italy	305	678	679	11.9%	374	122%	1	0%
Latvia	6	25	25	0.4%	19	314%	0	1%
Lithuania	20	45	46	0.8%	25	126%	0	0%
Luxembourg	2	38	36	0.6%	34	1479%	-2	-4%
Malta	1	3	3	0.1%	3	408%	0	3%
Netherlands	24	152	155	2.7%	131	549%	2	1%
Poland	63	514	503	8.8%	440	699%	-12	-2%
Portugal	26	110	117	2.1%	91	352%	7	6%
Romania	27	165	175	3.1%	147	538%	9	6%
Slovakia	37	64	62	1.1%	25	69%	-1	-2%
Slovenia	9	48	43	0.7%	34	396%	-6	-12%
Spain	169	690	660	11.5%	491	291%	-30	-4%
Sweden	12	95	96	1.7%	84	670%	1	1%
EU-27	**1 336**	**5 857**	**5 725**	**100%**	**4 389**	**328%**	**-132**	**-2%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
The information on methodologies and emission factors is not available from the JSON on fuels level Only information from major emitters have been included to the table as well as voluntarily provided information by countries. Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.

Figure 3.105 shows the time series of N_2O emissions in EU from road transport – diesel oil and the highest shares of countries. Figure 3.106 1A3b Road Transportation – Diesel Oil: N2O Implied Emission Factor (IEF) in EU (in kg/TJ) shows the N_2O implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the N_2O IEF at EU level increased from 1.37 kg/TJ in 1990 to 3.2 kg/TJ in 2023.

Figure 3.105 1A3b Road Transportation – Diesel Oil: Time series of N_2O emissions in EU and highest shares of countries

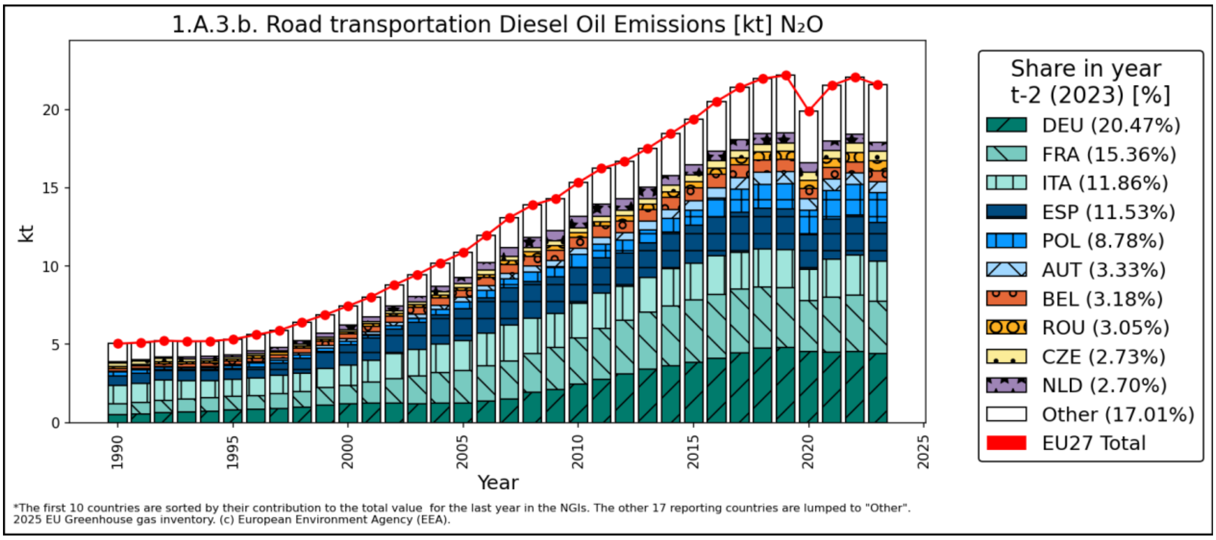
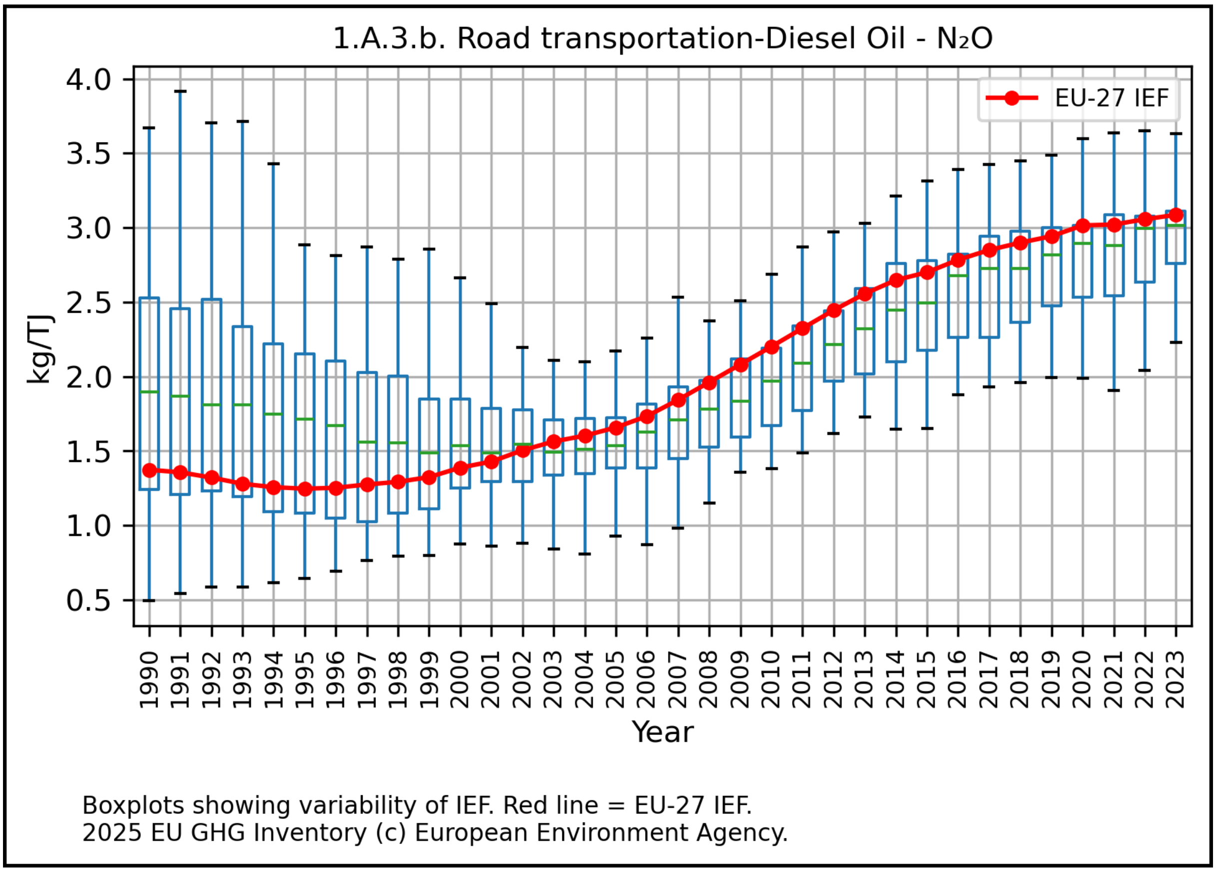


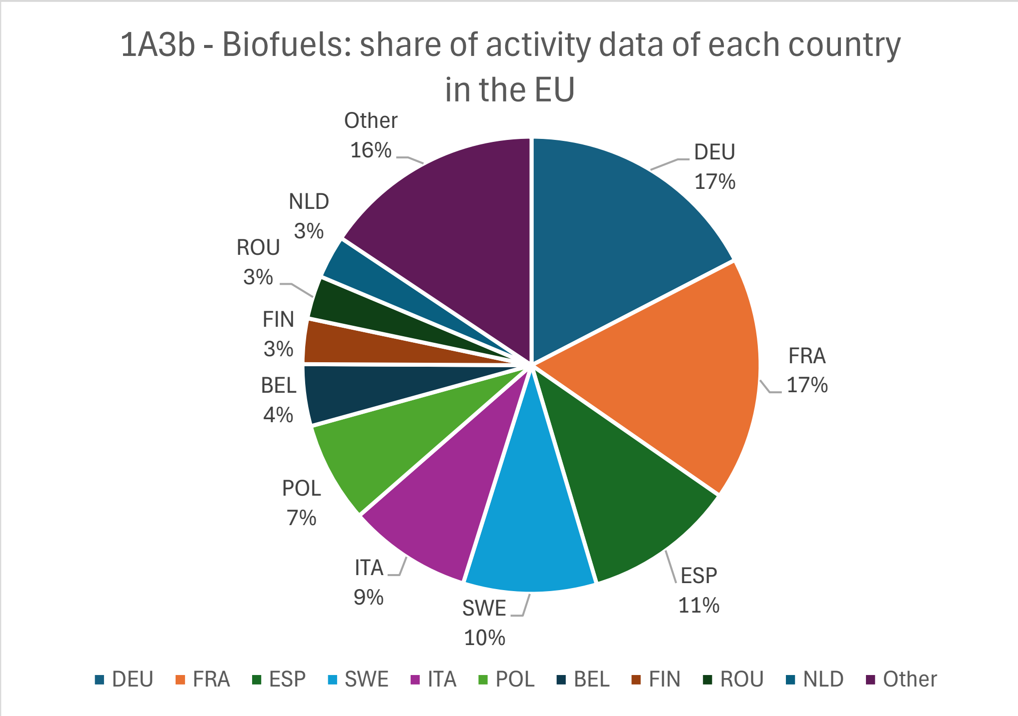
Figure 3.106 1A3b Road Transportation – Diesel Oil: N_2O Implied Emission Factor (IEF) in EU (in kg/TJ)



1A3b Road Transportation – Biofuels (activity data)

Figure 3.107 shows the share of activity data biofuels of each country in EU (%) in 2023. Top five countries in 2023 were France, Germany, Italy, Sweden, and Spain, which accounted for the 64 % of the EU value.

Figure 3.107 1A3b Road Transportation – Biofuels: Share of activity data of each country in EU (%)



3.6.3.3 Railways (1A3c) (EU)

The mobile source category 1A3c Railways includes all types of locomotives operating mainly on liquid fuels; in addition, there is a small part of solid fuels usage.

CO_2 emissions from 1A3c Railways

CO_2 emissions from railways accounted only for 0.11 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only railways, CO_2 accounted for 95.7 % of total GHG emissions from railways in EU, 2023.

The time series of CO_2 emissions and activity data from 1A3c Railways, years 1990-2023, are shown in Figure 3.108. From this figure it can be observed that the largest contribution to emissions comes from the usage of liquid fuels.

Figure 3.108 1A3c Railways: CO_2 emissions (in Mt) and activity data (in TJ)

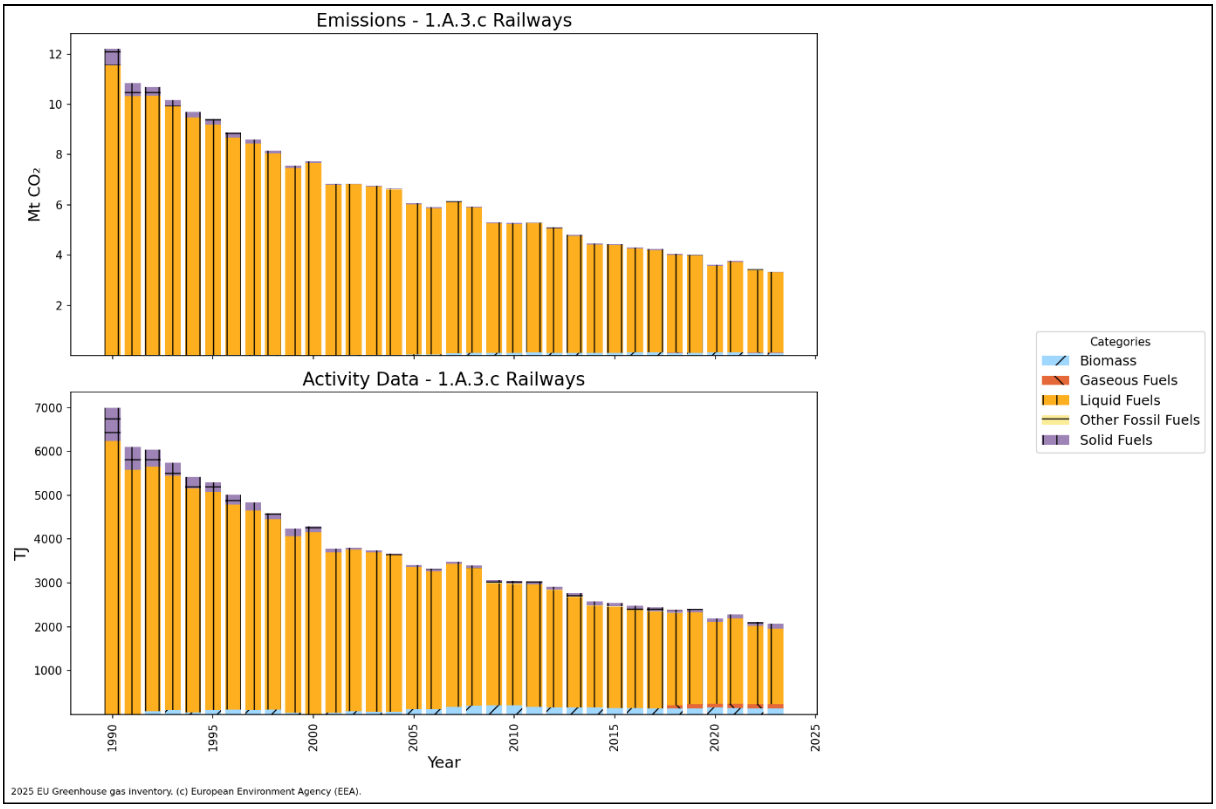


Table 3.68 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3c Railways. Between 1990 and 2023, CO_2 emissions decreased by 74 % in the EU, while between 2022 and 2023 the corresponding change was 3 % decrease. Top three countries in 2023 were Germany, Romania, and France, which accounted for the 44 % of the EU value.

Table 3.68 1A3c Railways: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	178	80	73	2.3%	-105	-59%	-7	-9%	NA,T2	CS,NA
Belgium	227	70	70	2.2%	-157	-69%	0	1%	NA,T1	CS,D,NA
Bulgaria	323	32	30	0.9%	-293	-91%	-3	-8%	NA,T1	D,NA
Croatia	140	47	38	1.2%	-102	-73%	-8	-18%	NA,T1	D,NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	768	229	219	6.8%	-549	-72%	-10	-4%	NA,T1,T2	CS,D,NA
Denmark	297	180	175	5.4%	-123	-41%	-5	-3%	NA,T2	D,NA,OTH
Estonia	159	39	42	1.3%	-117	-73%	4	10%	NA,T2	CS,NA
Finland	191	59	56	1.7%	-135	-71%	-3	-5%	NA,T2	CS,NA
France	1 078	355	333	10.3%	-745	-69%	-22	-6%	T2	CS
Germany	3 133	810	777	24.1%	-2 356	-75%	-33	-4%	CS,M,NA,T1	CS,D,M,NA
Greece	199	21	13	0.4%	-186	-94%	-9	-40%	NA,T2	CS,NA
Hungary	534	108	105	3.2%	-429	-80%	-3	-3%	NA,T2	CS,NA
Ireland	133	118	123	3.8%	-10	-7%	6	5%	NA,T2	CS,NA
Italy	613	35	37	1.1%	-577	-94%	2	5%	NA,T2	CS,NA
Latvia	537	72	67	2.1%	-469	-87%	-5	-7%	NA,T1,T2	CS,D,NA
Lithuania	350	83	86	2.7%	-264	-76%	2	3%	NA,T1,T2	CS,D,NA
Luxembourg	25	6	6	0.2%	-19	-75%	0	4%	NA,T1,T2	CS,D,NA
Malta	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Netherlands	91	60	68	2.1%	-23	-25%	8	13%	NA,T2	CS,NA
Poland	1 624	253	257	8.0%	-1 367	-84%	4	2%	NA,T1	D,NA
Portugal	177	22	24	0.7%	-153	-87%	2	10%	T1	D
Romania	473	316	313	9.7%	-160	-34%	-3	-1%	NA,T1,T2	CS,D,NA
Slovakia	372	82	81	2.5%	-291	-78%	-1	-1%	NA,T1	CS,NA
Slovenia	65	21	21	0.7%	-44	-67%	0	1%	NA,T1	D,NA
Spain	422	188	174	5.4%	-248	-59%	-14	-7%	NA,T1	D,NA
Sweden	103	41	39	1.2%	-64	-62%	-3	-6%	NA,T2	CS,NA
EU-27	**12 213**	**3 326**	**3 226**	**100%**	**-8 986**	**-74%**	**-100**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

1A3c Railways – Liquid Fuels (CO_2)

CO_2 emissions from liquid fuels accounted for 94.3 % of total GHG emissions from railways in 2023. Table 3.69 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3c Railways – liquid fuels. Between 1990 and 2023, CO_2 emissions decreased by 72 % in the EU, while between 2022 and 2023 the corresponding change was 3 % decrease. Top three countries in 2023 were Germany, Romania, and France, which accounted for the 44 % of the EU value.

Table 3.69 1A3c Railways – Liquid Fuels: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	171	80	73	2.3%	-98	-57%	-7	-9%	T2	CS
Belgium	227	70	70	2.2%	-157	-69%	0	1%	T1	CS,D
Bulgaria	323	32	30	0.9%	-293	-91%	-3	-8%	T1	D
Croatia	119	47	38	1.2%	-81	-68%	-8	-18%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	768	227	217	6.8%	-551	-72%	-9	-4%	T2	CS
Denmark	297	173	168	5.3%	-130	-44%	-5	-3%	T2	D
Estonia	142	39	42	1.3%	-100	-70%	4	10%	T2	CS
Finland	191	59	56	1.7%	-135	-71%	-3	-5%	T2	CS
France	1 078	354	332	10.4%	-746	-69%	-22	-6%	T2	CS
Germany	2 858	776	743	23.4%	-2 115	-74%	-33	-4%	CS,M	CS,M
Greece	199	21	13	0.4%	-186	-94%	-9	-40%	T2	CS
Hungary	528	108	105	3.3%	-424	-80%	-3	-3%	T2	CS
Ireland	133	118	123	3.9%	-10	-7%	6	5%	T2	CS
Italy	613	35	37	1.2%	-577	-94%	2	5%	T2	CS
Latvia	537	72	67	2.1%	-470	-87%	-5	-7%	T2	CS
Lithuania	350	83	85	2.7%	-265	-76%	2	3%	T2	CS
Luxembourg	25	6	6	0.2%	-19	-75%	0	4%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	91	60	67	2.1%	-23	-26%	8	13%	T2	CS
Poland	1 319	253	257	8.1%	-1 062	-81%	4	2%	T1	D
Portugal	177	22	24	0.7%	-153	-87%	2	10%	T1	D
Romania	440	316	313	9.8%	-128	-29%	-3	-1%	T1,T2	CS,D
Slovakia	372	82	81	2.6%	-291	-78%	-1	-1%	T1	CS
Slovenia	65	21	21	0.7%	-44	-67%	0	1%	T1	D
Spain	422	188	174	5.5%	-248	-59%	-14	-7%	T1	D
Sweden	103	41	39	1.2%	-64	-62%	-3	-6%	T2	CS
EU-27	**11 549**	**3 281**	**3 182**	**100%**	**-8 368**	**-72%**	**-99**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

Figure 3.109 shows the time series of CO_2 emissions in EU from railways – liquid fuels and the highest shares of countries. Figure 3.110 1A3c Railways – Liquid Fuels: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 73.8 - 74 t/TJ.

Figure 3.109 1A3c Railways – Liquid Fuels: Time series of CO_2 emissions in EU and highest shares of countries

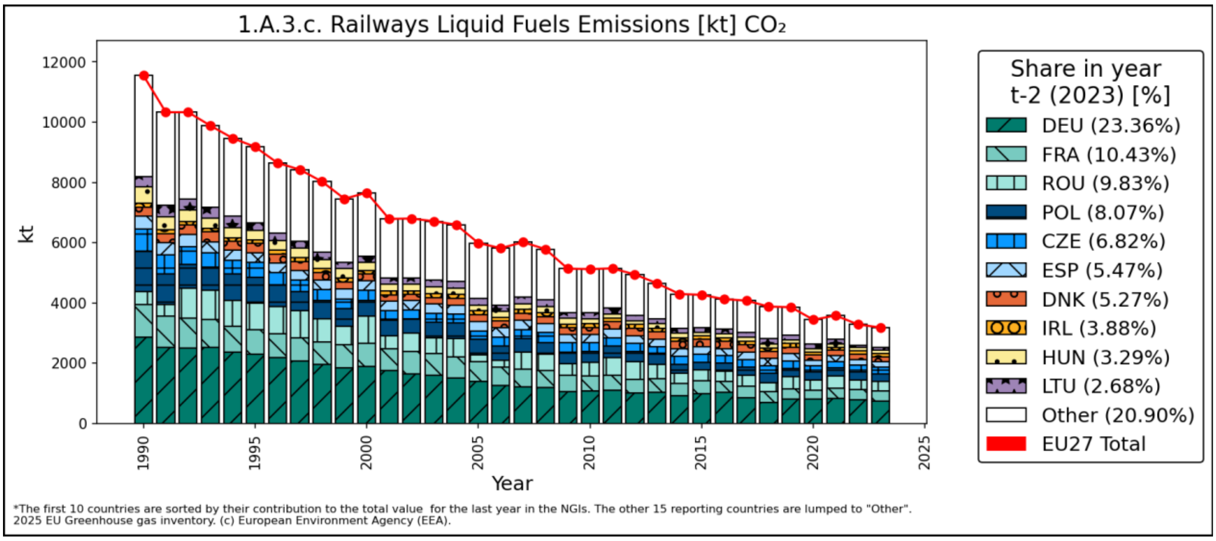
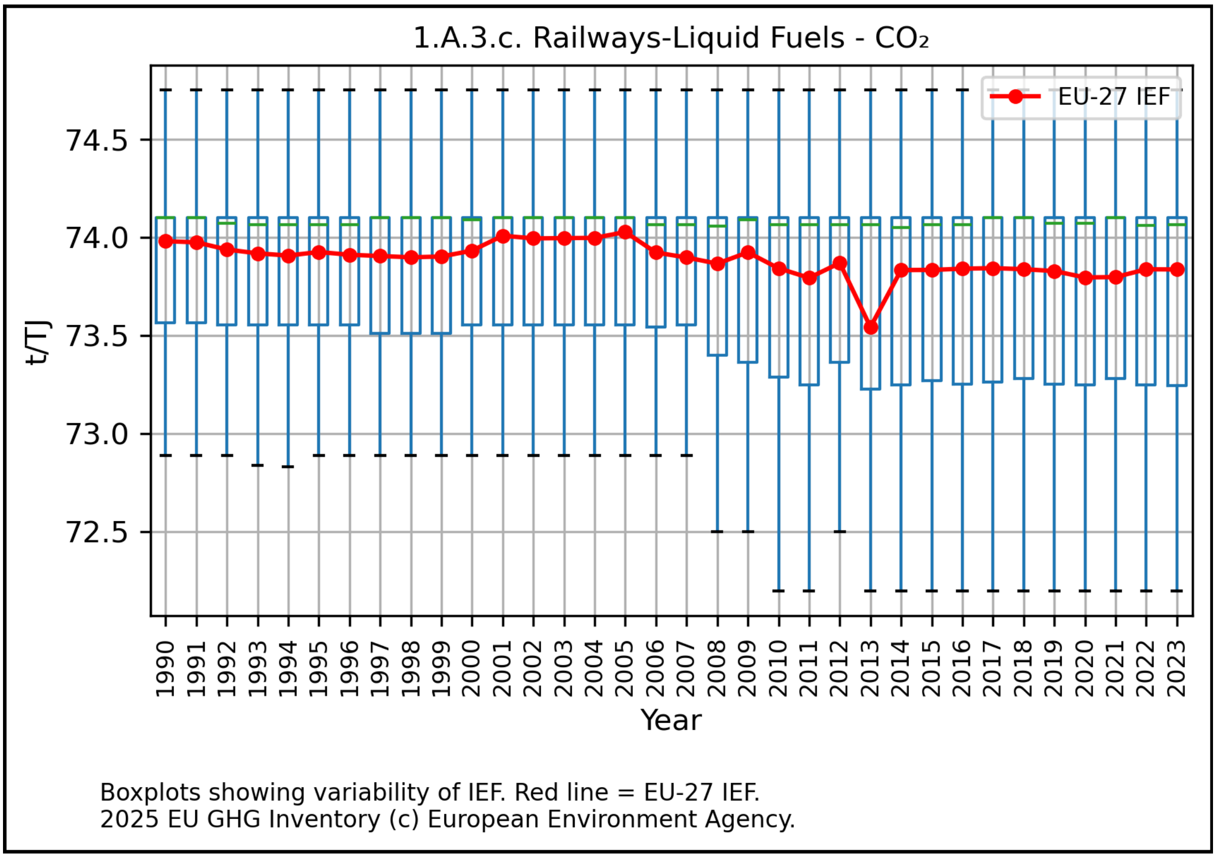


Figure 3.110 1A3c Railways – Liquid Fuels: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



3.6.3.4 Domestic Navigation (1A3d) (EU)

This mobile source category includes emissions from domestic waterborne transport, i.e. passenger and freight activity of trips having their origin and destination (O-D) within the same country. The main fuel used is gas/diesel oil, followed by residual fuel oil, while there is also a small part of gasoline. The emissions from military mobile sources related to navigation are excluded from 1A3d and are reported separately under category 1A5b (Other mobile military use). Fishing vessels are also excluded and they are reported separately under category 1A4ciii (Other sectors – Fishing).

CO_2 emissions from 1A3d Domestic Navigation

CO_2 emissions from domestic navigation accounted only for 0.5 % of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation). Considering only domestic navigation, CO_2 accounted for 98.2 % of total GHG emissions from domestic navigation in EU, 2023.

The time series of CO_2 emissions and activity data from 1A3d Domestic navigation, years 1990-2023, are shown in Figure 3.111. From this figure it can be observed that the largest contribution to emissions comes from the usage of gas/diesel oil, followed by residual fuel oil.

Figure 3.111 1A3d Domestic Navigation: CO_2 emissions (in Mt) and activity data (in TJ)

Table 3.70 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3d Domestic Navigation. Between 1990 and 2023, CO_2 emissions decreased by 28 % in the EU, while between 2022 and 2023 the corresponding change was 6 % decrease. Top three countries in 2023 were Italy, Spain, and Greece, which accounted for the 59 % of the EU value.

Table 3.70 1A3d Domestic Navigation: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	28	69	69	0.4%	41	147%	0	1%	NA,T2	CS,NA
Belgium	399	389	380	2.3%	-19	-5%	-9	-2%	NA,T1,T3	CS,D,NA
Bulgaria	56	5	6	0.0%	-51	-90%	1	26%	NA,T1	D,NA
Croatia	134	153	148	0.9%	13	10%	-5	-3%	NA,T1	D,NA
Cyprus	2	4	6	0.0%	4	165%	1	31%	NA,T1,T2	D,NA
Czechia	53	9	13	0.1%	-41	-76%	3	33%	NA,T2	CS,NA
Denmark	715	495	463	2.9%	-252	-35%	-32	-7%	NA,T2	CS,D,NA
Estonia	22	18	20	0.1%	-2	-8%	2	12%	NA,T2	CS,NA
Finland	441	340	315	1.9%	-126	-29%	-25	-7%	NA,T2	CS,NA
France	2 276	1 618	1 467	9.0%	-810	-36%	-152	-9%	T1	CS,D,OTH,PS
Germany	3 014	1 337	1 379	8.5%	-1 635	-54%	41	3%	CS,M,NA,T1	CS,M,NA
Greece	1 809	1 993	2 060	12.7%	252	14%	67	3%	NA,T1	CS,NA
Hungary	209	13	10	0.1%	-200	-95%	-3	-25%	NA,T1	D,NA
Ireland	85	303	284	1.7%	199	234%	-19	-6%	NA,T2	CS,NA
Italy	5 470	4 959	4 694	28.9%	-776	-14%	-265	-5%	NA,T1,T2	CS,NA
Latvia	1	5	3	0.0%	2	214%	-2	-42%	NA,T1,T2	CS,D,NA
Lithuania	15	10	8	0.0%	-8	-50%	-2	-19%	NA,T1	CS,NA
Luxembourg	1	1	1	0.0%	-1	-53%	0	13%	NA,T1,T2	CS,D,NA
Malta	12	57	78	0.5%	66	559%	20	36%	NA,T1	D,NA
Netherlands	726	851	915	5.6%	189	26%	64	8%	NA,T2	CS,NA
Poland	151	29	19	0.1%	-131	-87%	-9	-32%	NA,T1	D,NA
Portugal	263	278	293	1.8%	30	11%	15	5%	NO,T2	D,NO
Romania	1 142	144	150	0.9%	-992	-87%	6	4%	NA,T2	CS,NA
Slovakia	0	5	5	0.0%	5	23569%	0	1%	NA,T1	CS,NA
Slovenia	0	0	0	0.0%	0	432%	0	-2%	NA,T1	D,NA
Spain	5 203	3 446	2 776	17.1%	-2 427	-47%	-670	-19%	NA,T1,T2	CS,D,NA
Sweden	452	662	674	4.1%	221	49%	12	2%	NA,T2	CS,NA
EU-27	**22 680**	**17 192**	**16 232**	**100%**	**-6 447**	**-28%**	**-959**	**-6%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

1A3d Domestic Navigation – Gas/Diesel Oil (CO_2)

CO_2 emissions from gas/diesel oil accounted for 58.6 % of total GHG emissions from domestic navigation in 2023. Table 3.71 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3d Domestic navigation – gas/diesel oil. Between 1990 and 2023, CO_2 emissions decreased by 27 % in the EU, while between 2022 and 2023 the corresponding change was 1 % decrease. Top three countries in 2023 were Italy, Spain, Germany, and Italy, which accounted for the 54 % of the EU value.

Table 3.71 1A3d Domestic Navigation – Gas/Diesel Oil: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	18	62	63	0.6%	44	241%	1	1%	T2	CS
Belgium	399	389	380	3.9%	-19	-5%	-9	-2%	T1,T3	CS,D
Bulgaria	56	5	6	0.1%	-51	-90%	1	26%	T1	D
Croatia	128	153	148	1.5%	20	16%	-5	-3%	T1	D
Cyprus	2	4	6	0.1%	4	164%	1	31%	T1	D
Czechia	53	9	13	0.1%	-41	-76%	3	33%	T2	CS
Denmark	358	359	345	3.6%	-13	-4%	-14	-4%	T2	D
Estonia	22	18	20	0.2%	-2	-8%	2	12%	T2	CS
Finland	186	197	181	1.9%	-6	-3%	-16	-8%	T2	CS
France	742	581	535	5.5%	-207	-28%	-46	-8%	T1	CS,D,OTH,PS
Germany	2 754	1 270	1 319	13.6%	-1 435	-52%	49	4%	CS	CS,M
Greece	1 063	944	1 003	10.3%	-60	-6%	59	6%	T1	CS
Hungary	28	13	10	0.1%	-19	-66%	-3	-25%	T1	D
Ireland	22	303	284	2.9%	262	1177%	-19	-6%	T2	CS
Italy	2 326	2 184	2 399	24.7%	73	3%	215	10%	T1,T2	CS
Latvia	1	5	3	0.0%	2	230%	-2	-45%	T2	CS
Lithuania	15	10	8	0.1%	-8	-50%	-2	-19%	T1	CS
Luxembourg	1	0	1	0.0%	0	-44%	0	14%	T2	CS
Malta	6	56	75	0.8%	69	1080%	19	33%	T1	D
Netherlands	697	748	800	8.2%	102	15%	51	7%	T2	CS
Poland	81	29	19	0.2%	-62	-76%	-9	-32%	T1	D
Portugal	73	77	81	0.8%	8	11%	4	5%	T2	D
Romania	112	139	145	1.5%	33	30%	6	4%	T2	CS
Slovakia	0	5	5	0.1%	5	23569%	0	1%	T1	CS
Slovenia	0	0	0	0.0%	0	386%	0	-2%	T1	D
Spain	3 960	1 908	1 476	15.2%	-2 484	-63%	-432	-23%	T1	D
Sweden	181	330	371	3.8%	191	106%	42	13%	T2	CS
EU-27	**13 286**	**9 797**	**9 693**	**100%**	**-3 593**	**-27%**	**-103**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

Figure 3.112 shows the time series of CO_2 emissions in EU from domestic navigation – gas/diesel oil and the highest shares of countries. Figure 3.113 1A3d Domestic Navigation – Gas/Diesel Oil: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 74 – 74.3 t/TJ.

Figure 3.112 1A3d Domestic Navigation – Gas/Diesel Oil: Time series of CO_2 emissions in EU and highest shares of countries

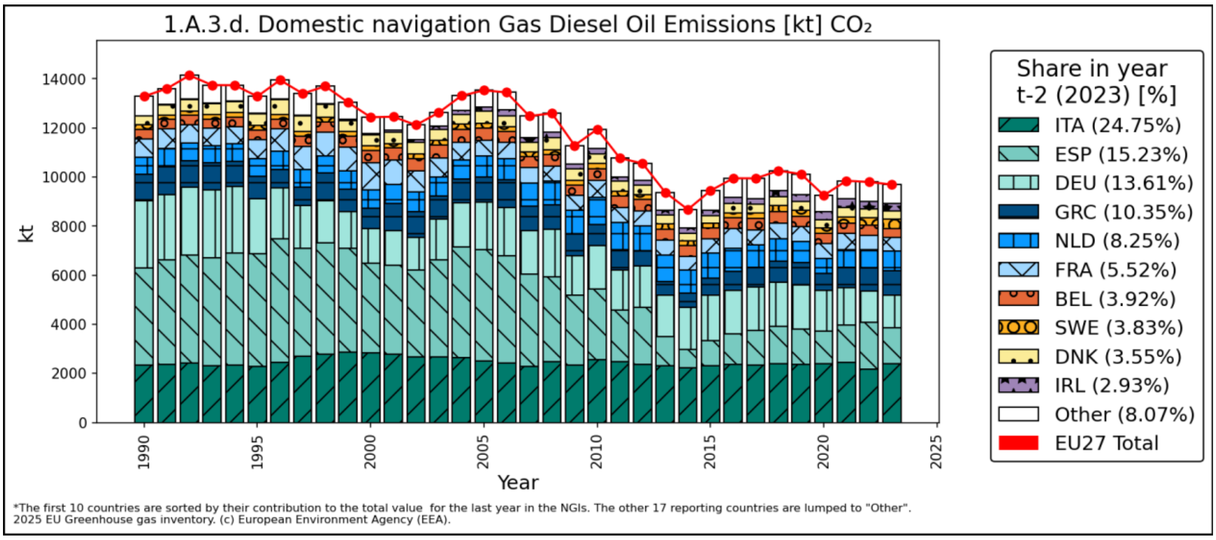
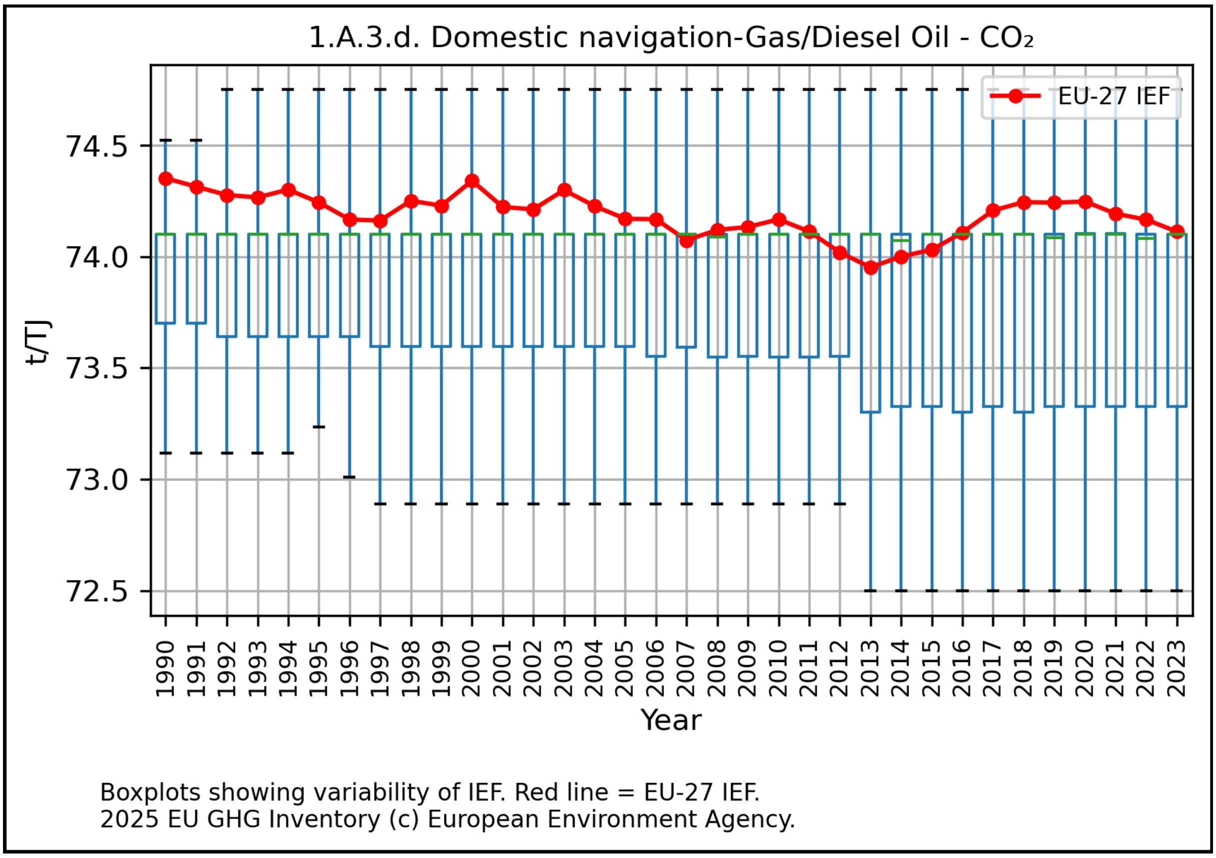


Figure 3.113 1A3d Domestic Navigation – Gas/Diesel Oil: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



1A3d Domestic Navigation – Residual Fuel Oil (CO_2)

CO_2 emissions from residual fuel oil accounted for 30.9 % of total GHG emissions from domestic navigation in 2023. Table 3.72 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3d Domestic navigation – residual fuel oil. Between 1990 and 2023, CO_2 emissions decreased by 35 % in the EU, while between 2022 and 2023 the corresponding change was 14 % decrease. Top three countries in 2023 were Italy, Spain, and Greece, which accounted for the 87 % of the EU value.

Table 3.72 1A3d Navigation, residual fuel oil: Member States' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	NO	NO	NO	-	-	-	-	-	NA	NA
Belgium	IE	IE	IE	-	-	-	-	-	NA	NA
Bulgaria	NO	NO	NO	-	-	-	-	-	NA	NA
Croatia	7	NO	NO	-	-7	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	NO	NO	NO	-	-	-	-	-	NA	NA
Denmark	357	132	113	2.2%	-244	-68%	-19	-14%	T2	CS
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	123	13	12	0.2%	-112	-91%	-2	-12%	T2	CS
France	990	247	140	2.7%	-850	-86%	-107	-43%	T1	CS,D,OTH,PS
Germany	240	18	18	0.4%	-221	-92%	0	0%	CS	CS,M
Greece	746	1 049	1 057	20.7%	312	42%	8	1%	T1	CS
Hungary	3	NO	NO	-	-3	-100%	-	-	NA	NA
Ireland	63	NO	NO	-	-63	-100%	-	-	NA	NA
Italy	2 576	2 555	2 085	40.9%	-491	-19%	-470	-18%	T1,T2	CS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	5	NO	1	0.0%	-4	-78%	1	∞	T1	D
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	70	NO	NO	-	-70	-100%	-	-	NA	NA
Portugal	190	201	211	4.1%	22	11%	11	5%	T2	D
Romania	1 030	NO	NO	-	-1 030	-100%	-	-	NA	NA
Slovakia	NO	NO	NO	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	1 242	1 538	1 300	25.5%	57	5%	-238	-15%	T2	CS
Sweden	195	168	164	3.2%	-31	-16%	-4	-3%	T2	CS
EU-27	**7 835**	**5 922**	**5 101**	**100%**	**-2 734**	**-35%**	**-820**	**-14%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

Figure 3.114 shows the time series of CO_2 emissions in EU from domestic navigation – residual fuel oil and the highest shares of countries. Figure 3.115 1A3d Domestic Navigation – Residual Fuel Oil: CO2 Implied Emission Factor (IEF) in EU (in t/TJ) shows the CO_2 implied emission factor (IEF) in EU and its variability due to differences among countries. It is observed that the CO_2 IEF at EU level is almost constant over the years at 77.6 - 78.0 t/TJ.

Figure 3.114 1A3d Domestic Navigation – Residual Fuel Oil: Time series of CO_2 emissions in EU and highest shares of countries

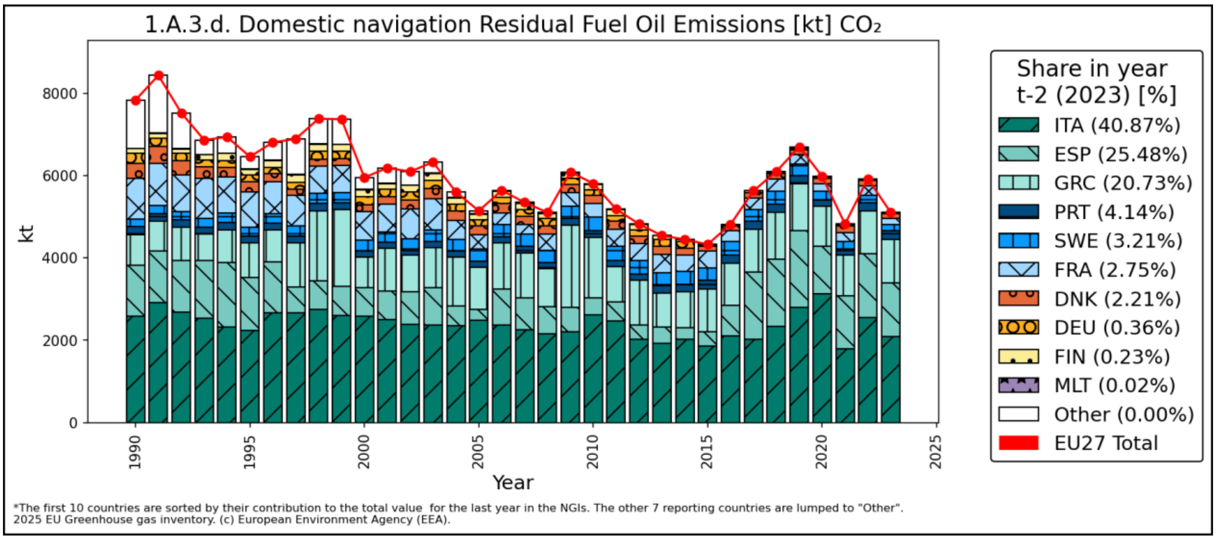
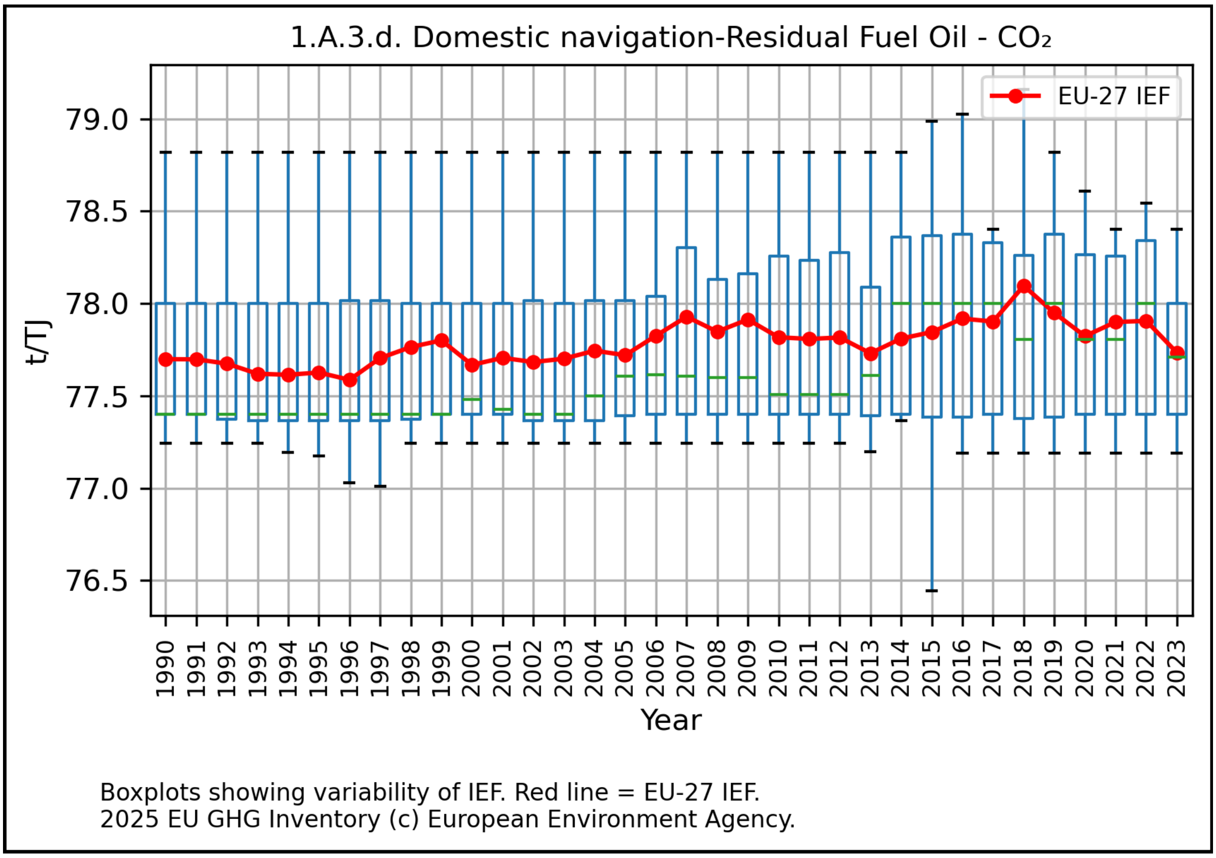


Figure 3.115 1A3d Domestic Navigation – Residual Fuel Oil: CO_2 Implied Emission Factor (IEF) in EU (in t/TJ)



3.6.3.5 Other (1A3e) (EU)

This mobile source category includes mainly emissions from pipeline transport using gaseous fuels; in addition, there is a small part from ground activities in airports and harbours using liquid fuels.

CO_2 emissions from 1A3e Other

CO_2 emissions from 1A3e Other accounted only for 0.14% of total GHG emissions in EU, 2023 (including indirect CO_2, with LULUCF and international aviation).

Table 3.73 shows the CO_2 emissions per country and at EU level (in kt), share of each country in EU (%), change between years, method and EF information for 1A3e Other. Between 1990 and 2023, CO_2 emissions decreased by 32 % in the EU, while between 2022 and 2023 the corresponding change was 17 % decrease. Top three countries in 2023 were Italy, Germany, and Belgium, which accounted for the 57 % of the EU value.

Table 3.73 1A3e Other: CO_2 emissions per country (in kt), share in EU (%), change, method and EF information

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	229	163	36	0.9%	-193	-84%	-127	-78%	NA,T2	CS,NA
Belgium	334	576	497	12.0%	163	49%	-79	-14%	CS,NA,T3	D,NA
Bulgaria	132	194	220	5.3%	88	67%	26	13%	NA,T2	CS,NA
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	5	22	2	0.0%	-4	-70%	-21	-93%	NA,T2	CS,NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	90	204	208	5.0%	118	131%	3	2%	NA,T2	CS,NA
Finland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
France	210	378	327	7.9%	117	55%	-50	-13%	NA,T2	CS,NA,PS
Germany	1 083	1 328	936	22.6%	-147	-14%	-392	-30%	CS,NA	CS,NA
Greece	NO	5	9	0.2%	9	∞	4	75%	NA,T1	CS,NA
Hungary	149	52	40	1.0%	-108	-73%	-12	-23%	NA,T2	CS,NA
Ireland	73	153	150	3.6%	77	105%	-3	-2%	NA,T2	CS,NA
Italy	411	982	946	22.8%	535	130%	-36	-4%	NA,T2	CS,NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	64	46	49	1.2%	-15	-24%	3	7%	NA,T2	CS,NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Netherlands	342	85	73	1.8%	-269	-79%	-12	-14%	NA,T2	CS,NA
Poland	NO	180	87	2.1%	87	∞	-94	-52%	NA,T1	D,NA
Portugal	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NO	NO
Romania	65	18	19	0.5%	-46	-71%	1	5%	NA,T1,T2	CS,D,NA
Slovakia	1 814	16	21	0.5%	-1 793	-99%	5	30%	NA,T2	CS,NA
Slovenia	NA,NO	0	0	0.0%	0	∞	0	-85%	NA,T2	CS,NA
Spain	19	242	185	4.5%	166	866%	-57	-24%	NA,T1	CS,D,NA
Sweden	1 035	336	336	8.1%	-699	-68%	0	0%	T2	CS
EU-27	**6 057**	**4 981**	**4 140**	**100%**	**-1 917**	**-32%**	**-841**	**-17%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Methods and emission factor information refer to the last inventory year.

3.6.4 Other Sectors (CRT Source Category 1.A.4.)

Category 1.A.4. mainly includes emissions from 'small scale fuel combustion' used for space heating and hot water production in commercial and institutional buildings, households, agriculture and forestry. It includes also emissions from mobile machinery used within these categories (e.g. mowers, harvesters, tractors, chain saws, motor pumps) as well as fuel used for grain drying, horticultural greenhouse heating or CO_2 fertilisation and stall heating. Category 1.A.4.c includes emissions from domestic inland, coastal, deep sea and international fishing. Emissions from transportation of agricultural goods are reported under category 1.A.3 Transport. The emissions reported under 1.A.4 can be generally defined as heat production processes for internal consumption.

The main driving force for CO_2 emissions in the 1.A.4 in energy consumption is the combustion for purposes of space heating. The fluctuations in consumption can be ascribed to differences in cold winter periods. The trend in eventually decreasing CO_2 emissions is a result of higher standards for new buildings and of successful execution of energy-efficiency-oriented modernization of existing buildings.

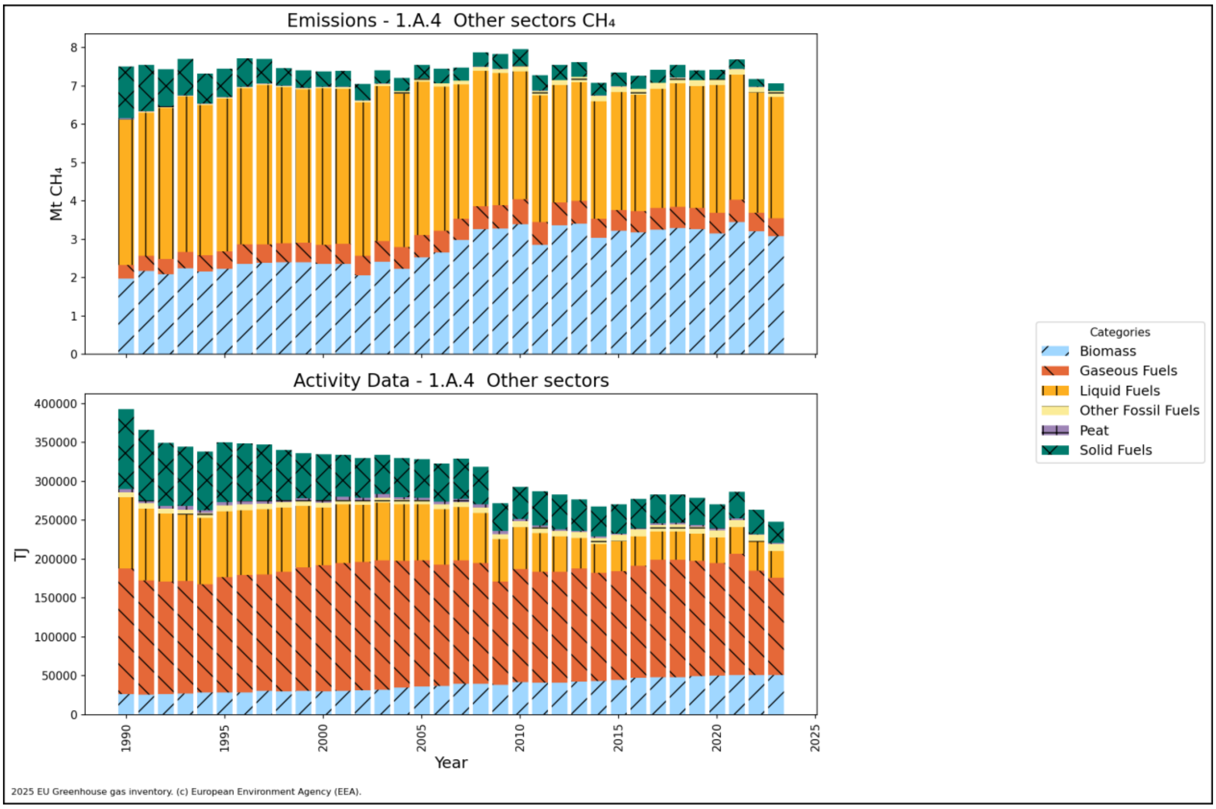
The following enumeration shows the correspondence of 1.A.4 subcategories and ISIC 3.1 rev codes:

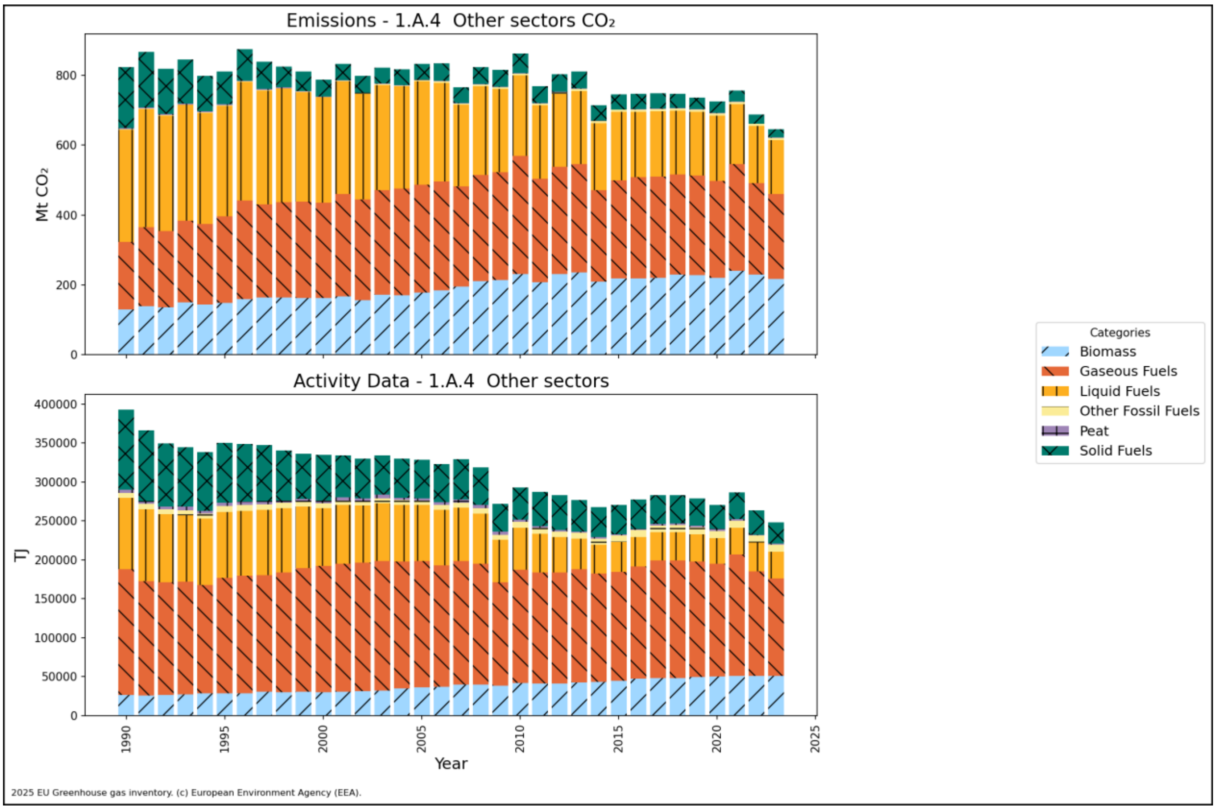
- 1.A.4.a Commercial/Institutional: ISIC categories 4103, 42, 6, 719, 72, 8, and 91-96
- 1.A.4.b Residential: All emissions from fuel combustion in households
- 1.A.4.c Agriculture/Forestry/Fishing: ISIC categories 05, 11, 12, 1302

In 2022 category 1.A.4 contributed to 445 070 kt CO_2 equivalents of which 94.8% CO_2, 3.7% CH_4 and 1.4% N_2O.

Figure 3.116 shows the trend of total GHG emissions within source category 1.A.4 and the dominating sources that are CO_2 emissions from 1.A.4.b Residential and from 1.A.4.a Commercial/Institutional. The emission trends of the large key sources show larger fluctuations between 1990 and 2023. Between 1990 and 2023, emissions from 1.A.4 decreased by 38%. From 2022 to 2023 emissions decreased by 6% (30,6 Mt CO_2 equivalents) which is mainly due to the decrease of category 1.A.4.a CO_2 emissions which decreased by 7%. The trend of 1.A.4 CO_2 emissions between 1990 and 2023 is mostly influenced by Germany (-112,8 Mt CO_2).

Figure 3.116 1.A.4. Other Sectors: Total, CO_2 and CH_4 emission trends





In 2023 GHG emissions from source category 1.A.4. accounted for 15.3% of total GHG emissions. This source category includes twelve key sources which contributed to 97.6% of total 1.A.4. GHG emissions in 2023. The following list shows the key sources and their contribution to total 1.A.4 GHG emissions for the year 2023:

1.A.4.a Commercial/Institutional: Gaseous Fuels (CO_2) – 16.2%

1.A.4.a Commercial/Institutional: Liquid Fuels (CO_2) - 4.6%

1.A.4.a Commercial/Institutional: Other Fuels (CO_2) - 1.4%

1.A.4.a Commercial/Institutional: Solid Fuels (CO_2) - 0.4%

1.A.4.b Residential: Biomass (CH_4) - 2.6%

1.A.4.b Residential: Gaseous Fuels (CO_2) – 35.8%

1.A.4.b Residential: Liquid Fuels (CO_2) - 16.0%

1.A.4.b Residential: Solid Fuels (CH_4) - 0.4%

1.A.4.b Residential: Solid Fuels (CO_2) - 4.6%

1.A.4.c Agriculture/Forestry/Fishing: Gaseous Fuels (CO_2) - 2.4%

1.A.4.c Agriculture/Forestry/Fishing: Liquid Fuels (CO_2) - 12.8%

1.A.4.c Agriculture/Forestry/Fishing: Solid Fuels (CO_2) - 0.4%

The following table shows the share of higher tier methods used for each key source of category 1.A.4. It comprises all methods and method combinations as reported by countries for any of the 1.A.4 key sources.

Table 3.74: Key source categories for level and trend analyses and share of EU emissions using higher tier methods for sector 1.A.4. (Table excerpt)

Source category gas	kt CO_2 eq.		Trend	Level		Share of higher Tier
	1990	2023		1990	2023	
1.A.4.a. Commercial/institutional: Gaseous Fuels (CO_2)	50377	72207	T	L	L	94%
1.A.4.a. Commercial/institutional: Liquid Fuels (CO_2)	73123	20392	T	L	L	80%
1.A.4.a. Commercial/institutional: Other Fuels (CO_2)	748	6169	T	0	L	97%
1.A.4.a. Commercial/institutional: Solid Fuels (CO_2)	45123	1836	T	L	0	98%
1.A.4.b. Residential: Biomass (CH_4)	10436	11375	T	L	L	50%
1.A.4.b. Residential: Gaseous Fuels (CO_2)	129929	159508	T	L	L	94%
1.A.4.b. Residential: Liquid Fuels (CO_2)	174109	70997	T	L	L	83%
1.A.4.b. Residential: Solid Fuels (CH_4)	8905	1795	T	L	0	8%
1.A.4.b. Residential: Solid Fuels (CO_2)	118831	20431	T	L	L	98%
1.A.4.c. Agriculture/forestry/fishing: Gaseous Fuels (CO_2)	12287	10502	T	L	L	87%
1.A.4.c. Agriculture/forestry/fishing: Liquid Fuels (CO_2)	65576	57137	T	L	L	77%
1.A.4.c. Agriculture/forestry/fishing: Solid Fuels (CO_2)	9740	1896	T	L	0	97%

The following table shows the share of specific tier methods used for each 1.A.4 category emission estimates. Most countries use combination of T1 and T2 method for emission estimates.

Table 3.75: Share of Tier methods for 1.A.4 by type of reported method and method combinations.

Methods and method combinations	Share of emissions which are estimated by specific Tier method
T1	0.8%
T1,T2	27.5%
T2	18.8%
T2,T3	0,7%
T1,T2,T3	13.9%
CS,T1,T2	4.6%
CS,T2,T3	25.8%
CS,T1,T2,T3	8.1%

Table 3.76 shows total GHG, CO_2 and CH_4 emissions from 1.A.4. Other sectors. Between 1990 and 2023 CO_2 emissions from 1.A.4. Other Sectors decreased by 38%, CH_4 decreased by 30% and N_2O emissions decreased by 3%.

Table 3.76 1.A.4. Other Sectors: Member States' contributions to total GHG, CO_2 and CH_4 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
Austria	14 287	7 250	13 543	6 854	574	273
Belgium	28 151	19 865	27 783	19 293	287	483
Bulgaria	8 146	1 349	7 654	1 027	320	250
Croatia	4 245	3 062	3 719	2 599	401	353
Cyprus	434	457	430	446	3	9
Czechia	33 991	9 784	31 955	8 797	1 879	877
Denmark	9 011	3 092	8 768	2 922	193	113
Estonia	1 800	399	1 718	379	76	15
Finland	7 750	3 058	7 490	2 824	183	187
France	98 422	58 964	91 891	55 826	5 223	1 949
Germany	209 594	110 273	204 022	108 732	4 692	1 155
Greece	8 643	5 077	8 066	4 741	267	264
Hungary	21 972	10 050	20 920	9 501	962	476
Ireland	10 515	7 558	9 918	7 359	505	119
Italy	78 868	68 903	76 042	64 446	1 278	2 474
Latvia	5 933	1 481	5 493	1 249	300	156
Lithuania	7 304	1 386	6 903	1 261	235	93
Luxembourg	1 361	1 403	1 343	1 385	13	14
Malta	265	138	264	136	1	1
Netherlands	39 917	25 535	39 235	24 072	637	1 413
Poland	57 185	47 097	53 442	42 612	3 142	3 408
Portugal	4 139	4 112	3 463	3 714	483	243
Romania	11 373	12 062	10 863	10 677	468	1 118
Slovakia	11 543	4 420	11 067	4 198	435	182
Slovenia	1 907	1 261	1 688	1 118	180	105
Spain	26 421	35 073	25 306	34 006	928	843
Sweden	10 934	1 962	10 722	1 843	132	60
EU-27	**714 112**	**445 070**	**683 706**	**422 016**	**23 795**	**16 632**

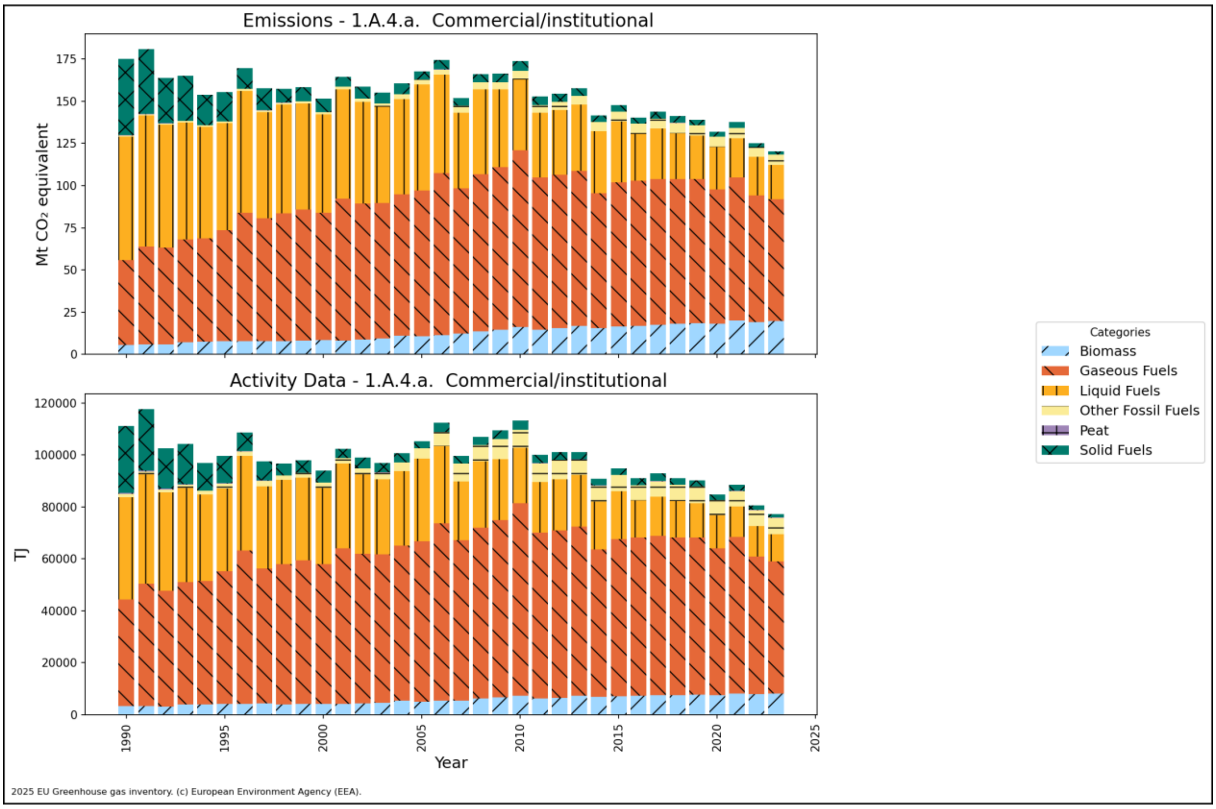
Abbreviations explained in the Chapter 'Units and abbreviations'.

3.6.4.1 Commercial/Institutional (1.A.4.a)

CO_2 emissions from 1.A.4.a Commercial/Institutional accounted for 4.4% of total GHG emissions from 1.A Fuel Combustion in 2023 and were in total 101 890 kt CO_2 eq. The subcategory 1.A.4.a. includes all combustion sources that utilize heat combustion for heating production halls and operational buildings in institutions, commercial facilities, services and trade.

Figure 3.117 shows the emission trend within the category 1.A.4.a, which is mainly dominated by CO_2 emissions from gaseous fuels. Between 1990 and 2023 CO_2 emissions decreased by 41% (see also the Table 3.77), mainly due to decreases in CO_2 emissions from solid (-96%) and liquid (-72%) fuels while CO_2 emissions from gaseous fuels increased by 51% and show a fluctuating trend since 2006. Between 2022 and 2023 the GHG emissions decreased by 5%, mainly driven by the decrease in liquid fuels and higher prices caused by the war in Ukraine.

Figure 3.117   1.A.4.a Commercial/Institutional: Total emission and activity trends



Main factors influencing CO_2 emissions from this source category are (1) outdoor temperature, (2) number and size of offices, (3) building codes, (4) thermal properties of building stock, (5) fuel split for heating and warm water, (6) use of renewable energy sources, e.g. biomass or solar panels, and (7) use of district heating. Fuel consumption in 1.A.4.a decreased by 31% between 1990 and 2023 and biomass consumption increased by 141%.

Table 3.77 1.A.4.a Commercial/Institutional: Member States' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	2 292	1 215	1 010	1.0%	-1 282	-56%	-205	-17%	NA,T2	CS,NA
Belgium	4 170	4 742	4 479	4.5%	309	7%	-262	-6%	NA,T1,T2	CS,D,NA
Bulgaria	3 117	335	319	0.3%	-2 798	-90%	-16	-5%	NA,T1,T2	CS,D,NA
Croatia	855	563	496	0.5%	-359	-42%	-67	-12%	NA,T1	D,NA
Cyprus	75	102	103	0.1%	28	37%	1	1%	NA,T1	D,NA
Czechia	9 907	2 302	2 049	2.0%	-7 858	-79%	-253	-11%	NA,T1,T2	CS,D,NA
Denmark	1 567	596	594	0.6%	-973	-62%	-2	0%	NA,T2,T3	CS,D,NA
Estonia	165	181	163	0.2%	-1	-1%	-17	-10%	T1,T2	CS,D
Finland	2 473	1 088	1 130	1.1%	-1 342	-54%	42	4%	NA,T2,T3	CS,NA
France	26 729	19 592	16 226	16.1%	-10 503	-39%	-3 367	-17%	T1,T2,T3	CS,D,OTH,PS
Germany	64 026	24 312	22 907	22.8%	-41 119	-64%	-1 405	-6%	-	-
Greece	519	612	647	0.6%	128	25%	35	6%	NA,T2	CS,NA
Hungary	2 766	2 452	2 014	2.0%	-752	-27%	-437	-18%	NA,T1,T2	CS,D,NA
Ireland	2 121	1 410	1 373	1.4%	-748	-35%	-37	-3%	NA,T2	CS,NA
Italy	11 902	19 294	20 975	20.8%	9 073	76%	1 682	9%	NA,T2	CS,NA
Latvia	2 726	420	421	0.4%	-2 305	-85%	1	0%	NA,T1,T2	CS,D,NA
Lithuania	3 059	285	295	0.3%	-2 763	-90%	10	4%	NA,T2	CS,NA
Luxembourg	639	473	457	0.5%	-182	-29%	-17	-4%	NA,T2	CS,NA
Malta	165	65	57	0.1%	-107	-65%	-8	-12%	NA,T1	D,NA
Netherlands	8 552	5 821	5 380	5.3%	-3 171	-37%	-441	-8%	NA,T2	CS,D,NA
Poland	9 715	5 927	5 262	5.2%	-4 453	-46%	-665	-11%	NA,T1,T2	CS,D,NA
Portugal	704	983	1 155	1.1%	450	64%	172	18%	NA	NA
Romania	IE,NO	2 088	2 250	2.2%	2 250	∞	162	8%	NA,T1,T2	CS,D,NA
Slovakia	4 148	1 365	1 333	1.3%	-2 815	-68%	-32	-2%	NA,T2	CS,NA
Slovenia	624	291	338	0.3%	-285	-46%	47	16%	NA,T1,T2	CS,D,NA
Spain	3 809	8 960	8 676	8.6%	4 866	128%	-284	-3%	CR,NA,T2	CR,CS,D,NA
Sweden	2 781	523	533	0.5%	-2 248	-81%	10	2%	T2	CS
EU-27	**169 604**	**105 998**	**100 644**	**100%**	**-68 960**	**-41%**	**-5 354**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.4. a Commercial/Institutional – Liquid Fuels (CO_2)

In 2023 CO_2 emissions from liquid fuels had a share of 20% within source category 1.A.4.a (compared to 41% in 1990). Between 1990 and 2023, CO_2 emissions decreased by 72% (Table 3.78) to 20 392 kt CO_2. Only three Member States increased the use of liquid fuels in the time series. Between 2022 and 2023 EU CO_2 emissions decreased by 12%.

Table 3.78 1.A.4.a Commercial/Institutional, liquid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	1 420	491	216	1.1%	-1 203	-85%	-275	-56%
Belgium	2 163	937	987	4.8%	-1 176	-54%	50	5%
Bulgaria	2 986	99	113	0.6%	-2 872	-96%	14	14%
Croatia	526	104	93	0.5%	-433	-82%	-10	-10%
Cyprus	75	102	103	0.5%	28	37%	1	1%
Czechia	2 000	40	58	0.3%	-1 942	-97%	18	47%
Denmark	1 162	238	261	1.3%	-902	-78%	23	10%
Estonia	140	68	73	0.4%	-66	-47%	5	7%
Finland	2 423	1 026	1 013	5.0%	-1 409	-58%	-13	-1%
France	16 555	6 806	5 050	24.8%	-11 505	-69%	-1 757	-26%
Germany	28 053	4 038	3 662	18.0%	-24 392	-87%	-377	-9%
Greece	499	334	359	1.8%	-140	-28%	24	7%
Hungary	864	77	77	0.4%	-788	-91%	0	0%
Ireland	1 759	555	566	2.8%	-1 194	-68%	11	2%
Italy	1 530	1 443	1 413	6.9%	-117	-8%	-30	-2%
Latvia	1 017	134	154	0.8%	-863	-85%	21	15%
Lithuania	1 166	7	9	0.0%	-1 157	-99%	2	27%
Luxembourg	469	274	268	1.3%	-202	-43%	-6	-2%
Malta	165	65	57	0.3%	-107	-65%	-8	-12%
Netherlands	692	473	431	2.1%	-262	-38%	-42	-9%
Poland	IE,NO	1 116	804	3.9%	804	∞	-312	-28%
Portugal	704	330	547	2.7%	-157	-22%	217	66%
Romania	IE,NO	243	249	1.2%	249	∞	6	2%
Slovakia	384	28	17	0.1%	-367	-96%	-11	-39%
Slovenia	391	176	221	1.1%	-170	-43%	45	26%
Spain	3 284	3 564	3 272	16.0%	-13	0%	-293	-8%
Sweden	2 695	313	320	1.6%	-2 375	-88%	7	2%
EU-27	**73 123**	**23 082**	**20 392**	**100%**	**-52 731**	**-72%**	**-2 689**	**-12%**

Notes: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
From 1990 to 1993 Poland does not report any liquid fuels for stationary sources and reports liquid fuels from 'Off-road vehicles and other machinery' under category 1A3 and therefore the notation key 'IE, NO' is reported.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.118 and Figure 3.119 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Fuel consumption decreased by 74% between 1990 and 2023. The CO_2 implied emission factor for liquid fuels was 71.89 t/TJ in 2023.

Figure 3.118 1.A.4.a Commercial/Institutional, liquid fuels: Emission trend and share for CO_2

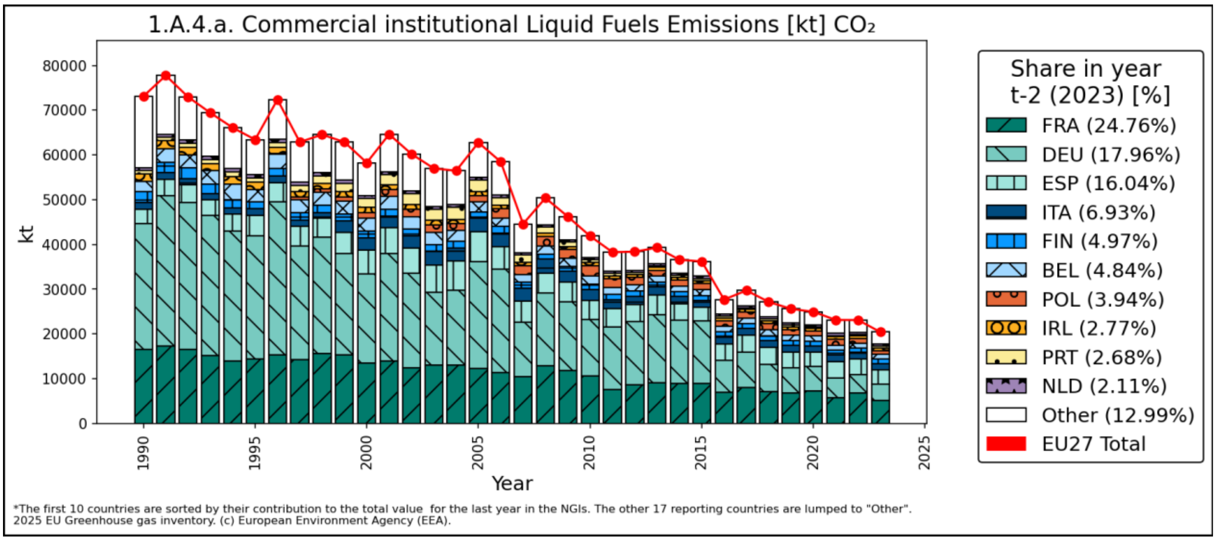
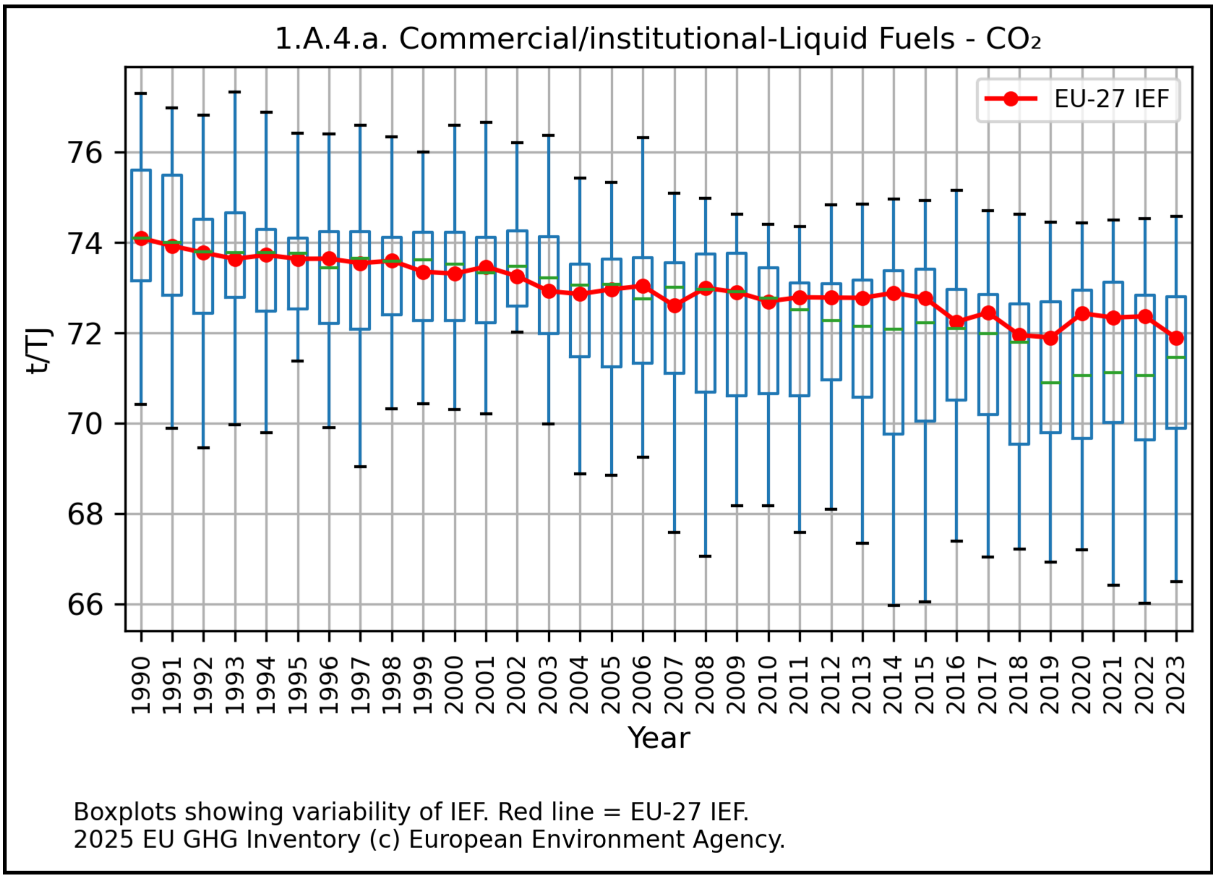


Figure 3.119 1.A.4.a Commercial/Institutional, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.a Commercial/Institutional – Solid Fuels (CO_2)

In 2023, CO_2 from solid fuels had a share of 2% within source category 1.A.4.a (compared to 25% in 1990). Between 1990 and 2023 CO_2 emissions decreased by 96% (Table 3.79). Between 2022 and 2023 CO_2 emissions decreased by 11%.

Table 3.79 1.A.4.a Commercial/Institutional, solid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	91	NO	NO	-	-91	-100%	-	-
Belgium	9	0	0	0.0%	-9	-100%	0	0%
Bulgaria	89	6	7	0.4%	-82	-92%	1	16%
Croatia	88	IE,NO	IE,NO	-	-88	-100%	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	6 237	96	45	2.4%	-6 192	-99%	-51	-53%
Denmark	8	NO	NO	-	-8	-100%	-	-
Estonia	NO	NO	2	0.1%	2	∞	2	∞
Finland	NO	NO	NO	-	-	-	-	-
France	2 078	137	119	6.5%	-1 959	-94%	-18	-13%
Germany	22 426	4	83	4.5%	-22 343	-100%	80	2265%
Greece	20	NO	NO	-	-20	-100%	-	-
Hungary	473	6	2	0.1%	-470	-99%	-4	-60%
Ireland	3	1	1	0.0%	-2	-67%	0	0%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	1 366	3	5	0.3%	-1 361	-100%	2	50%
Lithuania	1 173	85	49	2.7%	-1 124	-96%	-36	-43%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	101	NO	NO	-	-101	-100%	-	-
Poland	8 881	1 192	1 013	55.2%	-7 868	-89%	-179	-15%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	IE,NO	0	0	0.0%	0	∞	0	-58%
Slovakia	1 729	178	159	8.6%	-1 570	-91%	-19	-11%
Slovenia	203	NO	NO	-	-203	-100%	-	-
Spain	147	358	352	19.1%	205	140%	-6	-2%
Sweden	NO	NO	NO	-	-	-	-	-
EU-27	**45 123**	**2 066**	**1 836**	**100%**	**-43 287**	**-96%**	**-229**	**-11%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Greece reports emissions from stationary combustion as 'NO' and emissions from mobile sources as 'IE'
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.120 and Figure 3.121 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Fuel consumption in the EU decreased by 95% between 1990 and 2023. The CO_2 implied emission factor for solid fuels was 96.98 t/TJ in 2023.

Figure 3.120 1.A.4.a Commercial/Institutional, solid fuels: Emission trend and share for CO_2

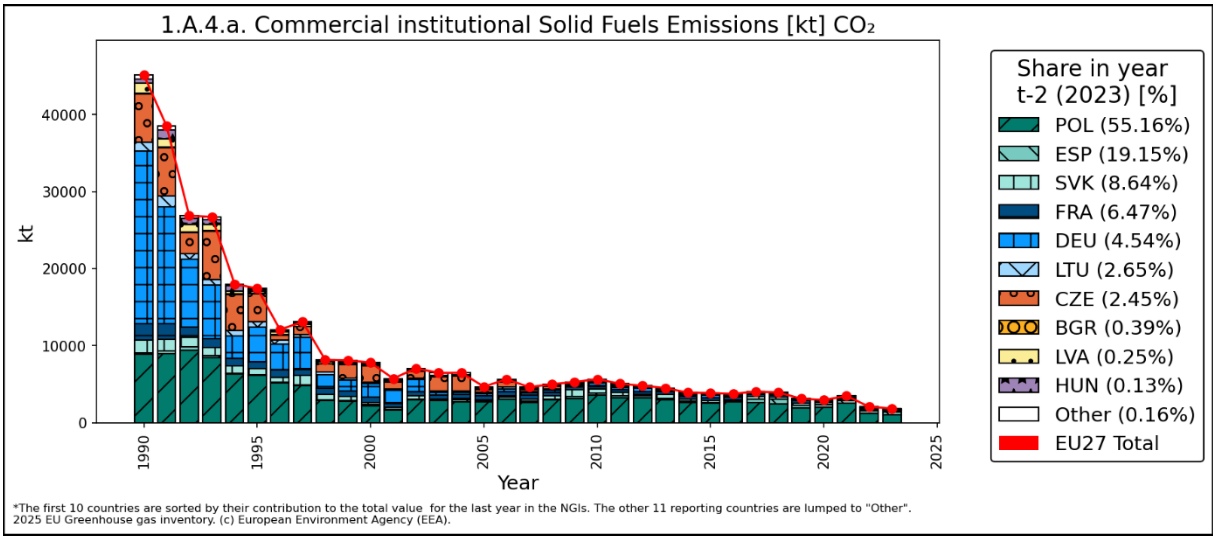
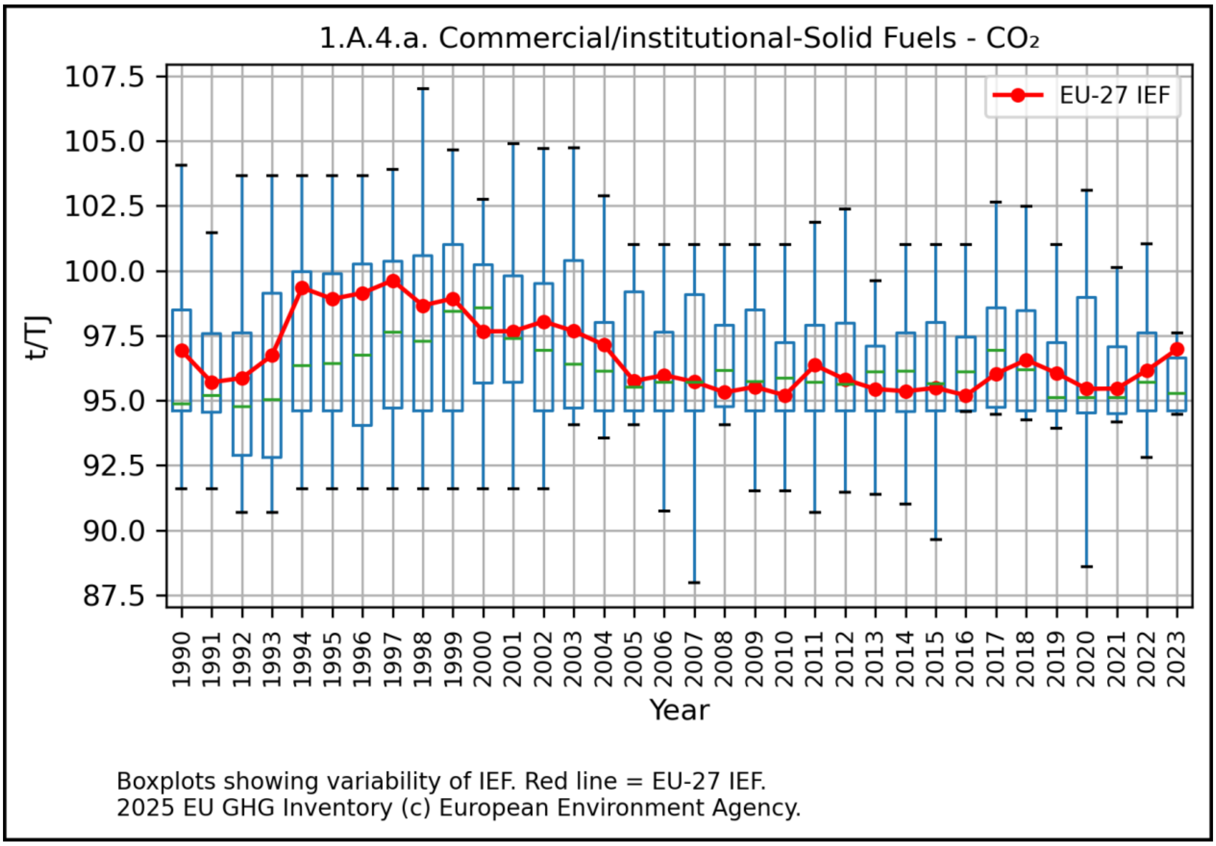


Figure 3.121 1.A.4.a Commercial/Institutional, solid fuels: of Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.a Commercial/Institutional – Gaseous Fuels (CO_2)

In 2022 CO_2 from gaseous fuels had a share of 72% within source category 1.A.4.a (compared to 34% in 1990). Between 1990 and 2023, the emissions increased by 43% (Table 3.80). Between 2022 and 2023 CO_2 emissions decreased by 4%.

Table 3.80 1.A.4.a Commercial/Institutional, gaseous fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	698	724	793	1.1%	96	14%	70	10%
Belgium	1 969	3 717	3 410	4.7%	1 441	73%	-307	-8%
Bulgaria	42	229	198	0.3%	156	372%	-31	-13%
Croatia	241	459	402	0.6%	162	67%	-57	-12%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	1 670	2 167	1 946	2.7%	276	17%	-221	-10%
Denmark	363	358	333	0.5%	-29	-8%	-25	-7%
Estonia	19	108	88	0.1%	69	371%	-20	-19%
Finland	37	51	106	0.1%	69	184%	55	107%
France	8 096	12 642	11 052	15.3%	2 956	37%	-1 590	-13%
Germany	13 547	20 269	19 161	26.5%	5 614	41%	-1 108	-5%
Greece	NO	278	288	0.4%	288	∞	11	4%
Hungary	1 429	2 204	1 763	2.4%	334	23%	-440	-20%
Ireland	223	855	807	1.1%	583	261%	-48	-6%
Italy	9 842	12 348	13 789	19.1%	3 947	40%	1 440	12%
Latvia	276	282	258	0.4%	-18	-7%	-24	-9%
Lithuania	708	167	214	0.3%	-494	-70%	47	28%
Luxembourg	170	200	189	0.3%	19	11%	-11	-5%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	7 758	5 348	4 949	6.9%	-2 809	-36%	-399	-7%
Poland	762	3 591	3 323	4.6%	2 561	336%	-268	-7%
Portugal	NO	652	607	0.8%	607	∞	-45	-7%
Romania	IE,NO	1 830	1 990	2.8%	1 990	∞	160	9%
Slovakia	2 035	1 159	1 157	1.6%	-878	-43%	-2	0%
Slovenia	29	115	117	0.2%	88	299%	2	2%
Spain	379	5 038	5 052	7.0%	4 674	1235%	15	0%
Sweden	86	210	212	0.3%	126	147%	3	1%
EU-27	**50 377**	**75 000**	**72 207**	**100%**	**21 830**	**43%**	**-2 794**	**-4%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.122 and Figure 3.123 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Fuel consumption increased by 25% between 1990 and 2023. The CO_2 implied emission factor for gaseous fuels was 56.70 t/TJ in 2023.

Figure 3.122 1.A.4.a Commercial/Institutional, gaseous fuels: Emission trend and share for CO_2

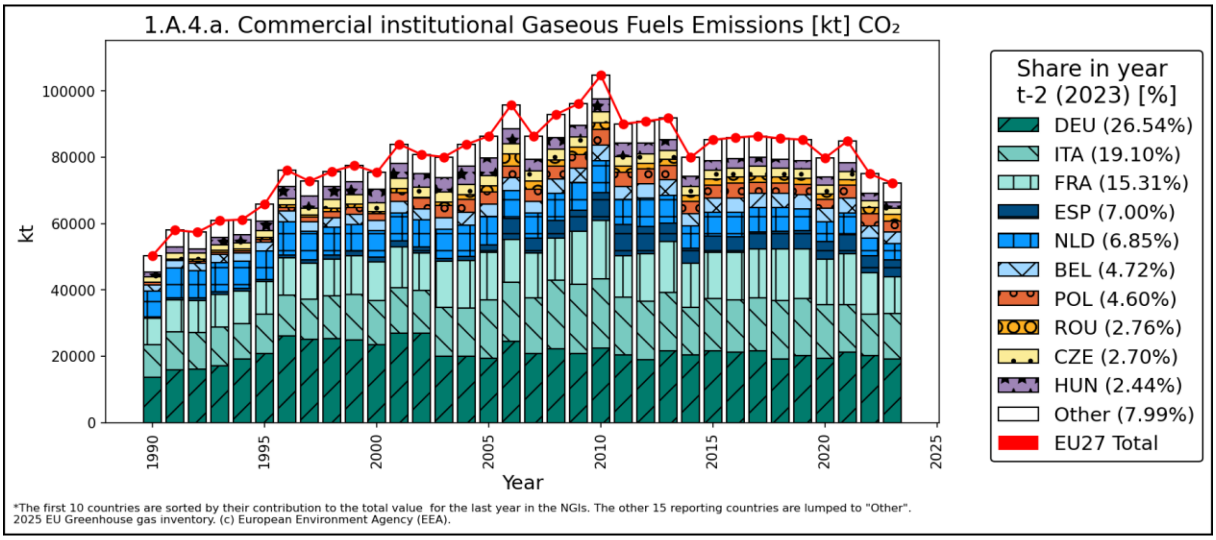
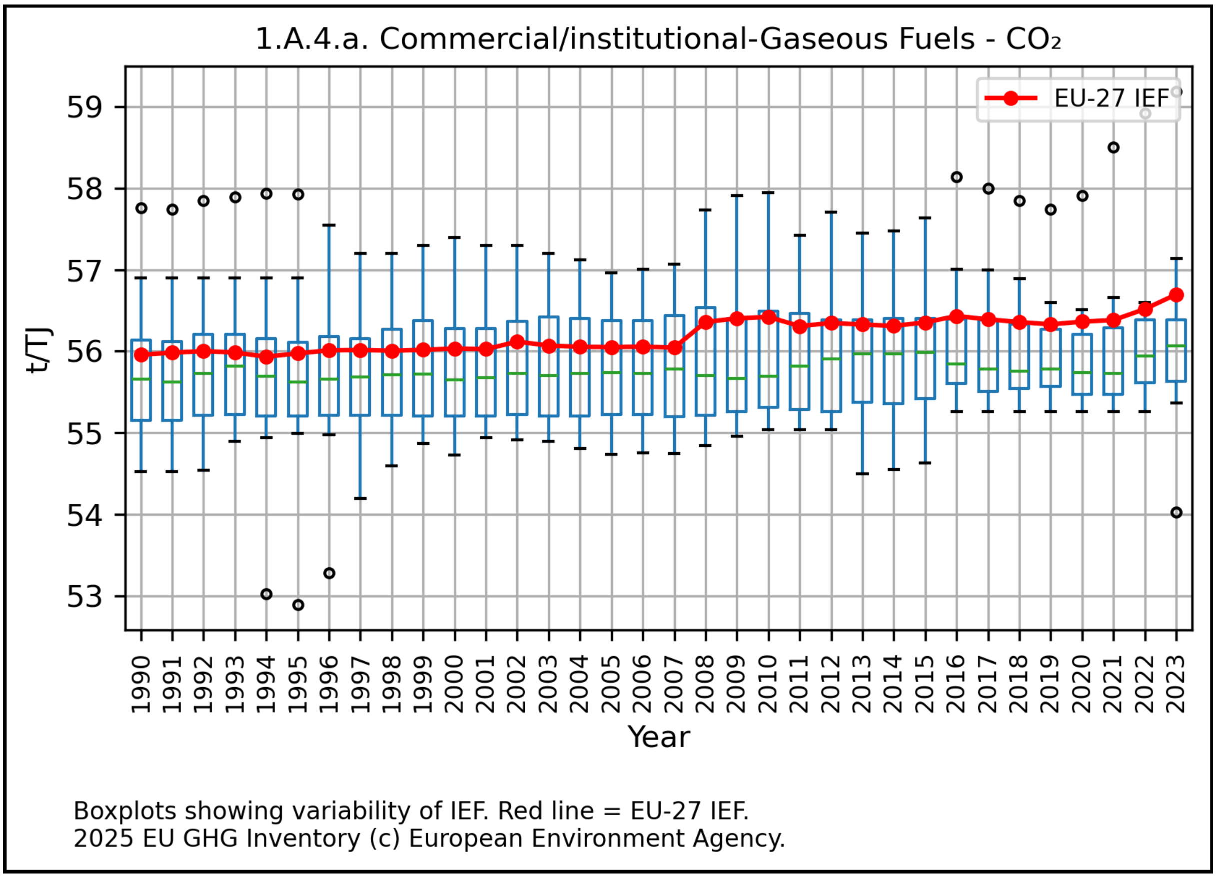


Figure 3.123 1.A.4.a Commercial/Institutional, gaseous fuels: Overview of outliers of Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.a Commercial/Institutional – Other Fossil Fuels (CO_2)

Under this key category Member States report CO_2 emissions from waste incineration plants with energy recovery, whose main economic activity is the treatment of waste (as opposed to waste incineration plants with energy recovery whose main economic activity is power and heat production; these are reported under 1A1a).

In 2023, CO_2 from other fossil fuels had a share of 6% within category 1.A.4.a. Between 1990 and 2023 CO_2 emissions increased by 724% (Table 3.81). Sixteen Member States report emissions as 'Not occurring' or 'Included elsewhere' in 2023 and seven other Member States estimate negligible amount of emissions; between 2022 and 2023 CO_2 decreased by 6%.

Table 3.81: 1.A.4.a Commercial/Institutional, other fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	83	0	0	0.0%	-83	-100%	0	-3%
Belgium	29	88	82	1.3%	53	184%	-5	-6%
Bulgaria	NO	NO	NO	-	-	-	-	-
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	0	0	0.0%	0	∞	0	-9%
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	34	NO	NO	-	-34	-100%	-	-
Estonia	NO	NO	NO	-	-	-	-	-
Finland	0	NO	NO	-	0	-100%	-	-
France	NO	7	5	0.1%	5	∞	-2	-25%
Germany	NA,NO	1	1	0.0%	1	∞	0	-2%
Greece	NO	NO	NO	-	-	-	-	-
Hungary	NO	165	172	2.8%	172	∞	7	4%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	530	5 502	5 774	93.6%	5 244	990%	272	5%
Latvia	NO	NO	NO	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	NO	1	1	0.0%	1	∞	0	-18%
Poland	72	27	122	2.0%	50	70%	95	346%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	IE,NO	15	11	0.2%	11	∞	-4	-29%
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	NO	NO	NO	-	-	-	-	-
Sweden	NO	1	1	0.0%	1	∞	0	17%
EU-27	**748**	**5 807**	**6 169**	**100%**	**5 421**	**724%**	**362**	**6%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. The information on methodologies and emission factors is not available from the JSON on fuels level Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.Figure 3.125 shows CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. The CO_2 implied emission factor for other fossil fuels was 98.39 t/TJ in 2022. The comparatively high implied emission factor is a calculated value from a mass balance calculation method and data from energy statistics.

Figure 3.124 1.A.4.a Commercial/Institutional, other fuels: Emission trend and share for CO_2

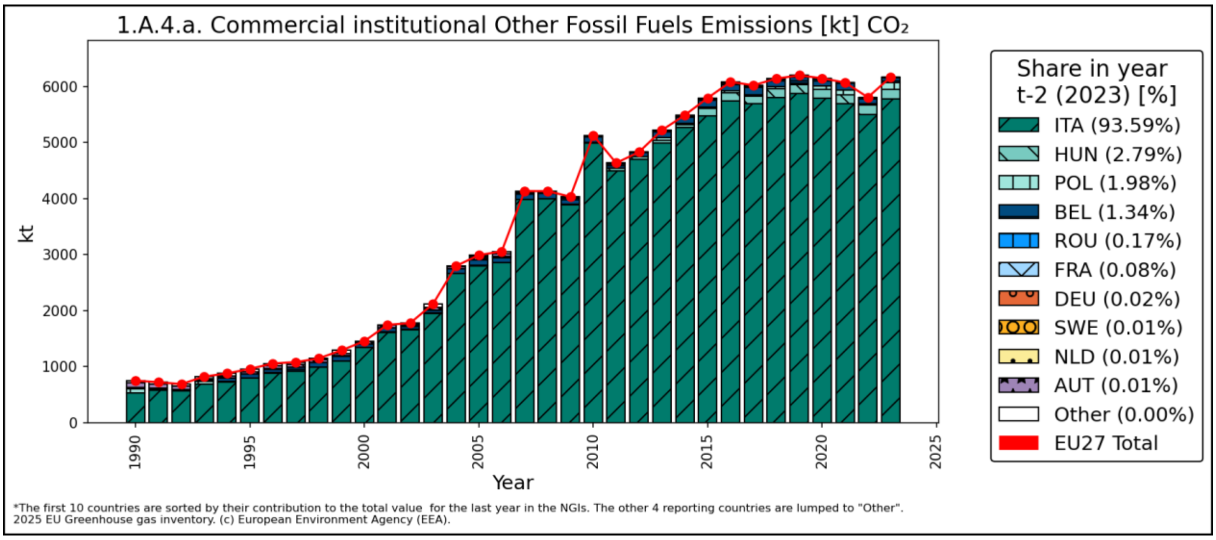
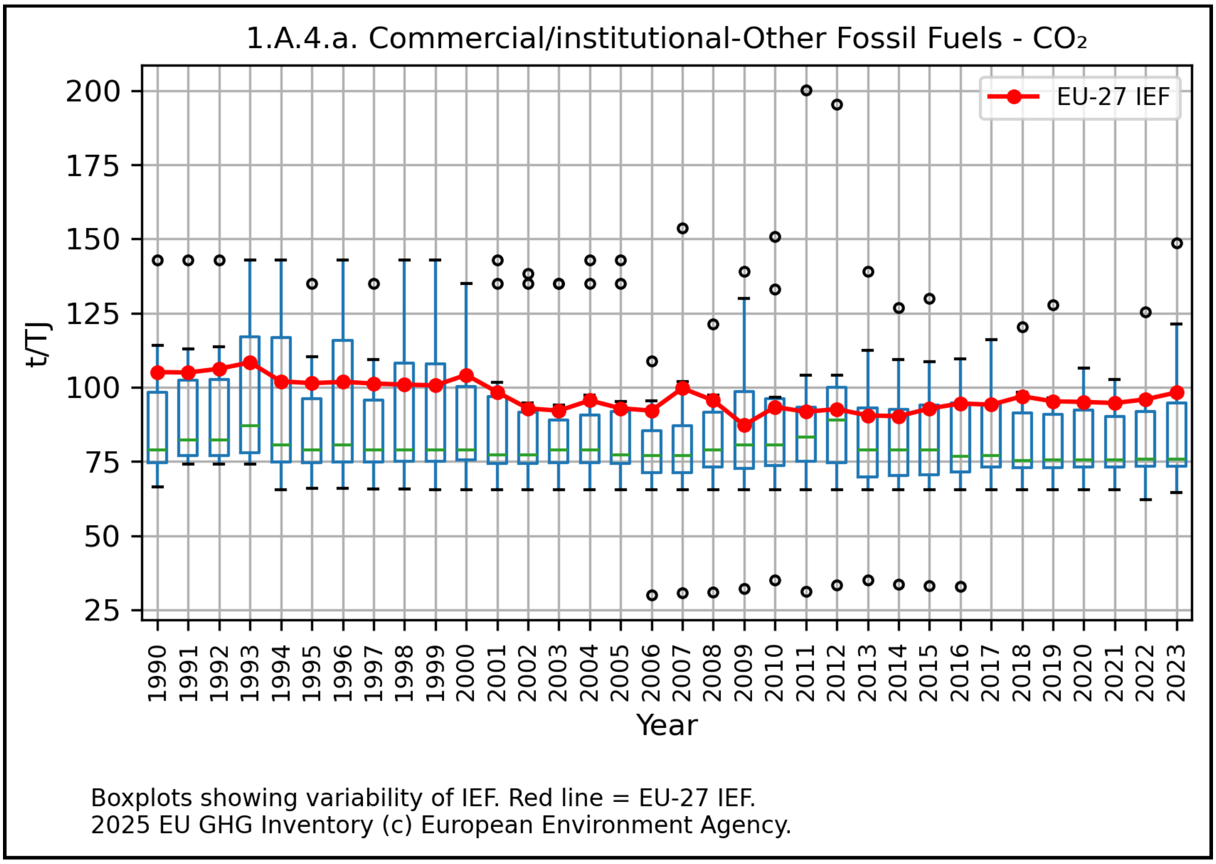


Figure 3.125 1.A.4.a Commercial/Institutional, other fuels: Overview of outliers of Implied Emission Factors for CO_2 (in t/TJ)



3.6.4.2 Residential (1.A.4.b)

CO_2 emissions from 1.A.4.b Residential account for 12% of total GHG emissions from 1.A Fuel Combustion in 2023.

Figure 3.126 shows the emission trend within the category 1.A.4.b, which is mainly dominated by CO_2 emissions from gaseous and liquid fuels. Total GHG emissions decreased by 40% since 1990, although CO_2 emissions from gaseous fuels increased strongly (23%) which was counterbalanced by decreasing emissions from liquid and solid fuels. From 2022 to 2023, CO_2 emissions decreased by 9% and energy consumption decreased by 24%. Biomass consumption reached a share of 28% in the year 2023 while the share of solid fossil fuels consumption dropped to 5%.

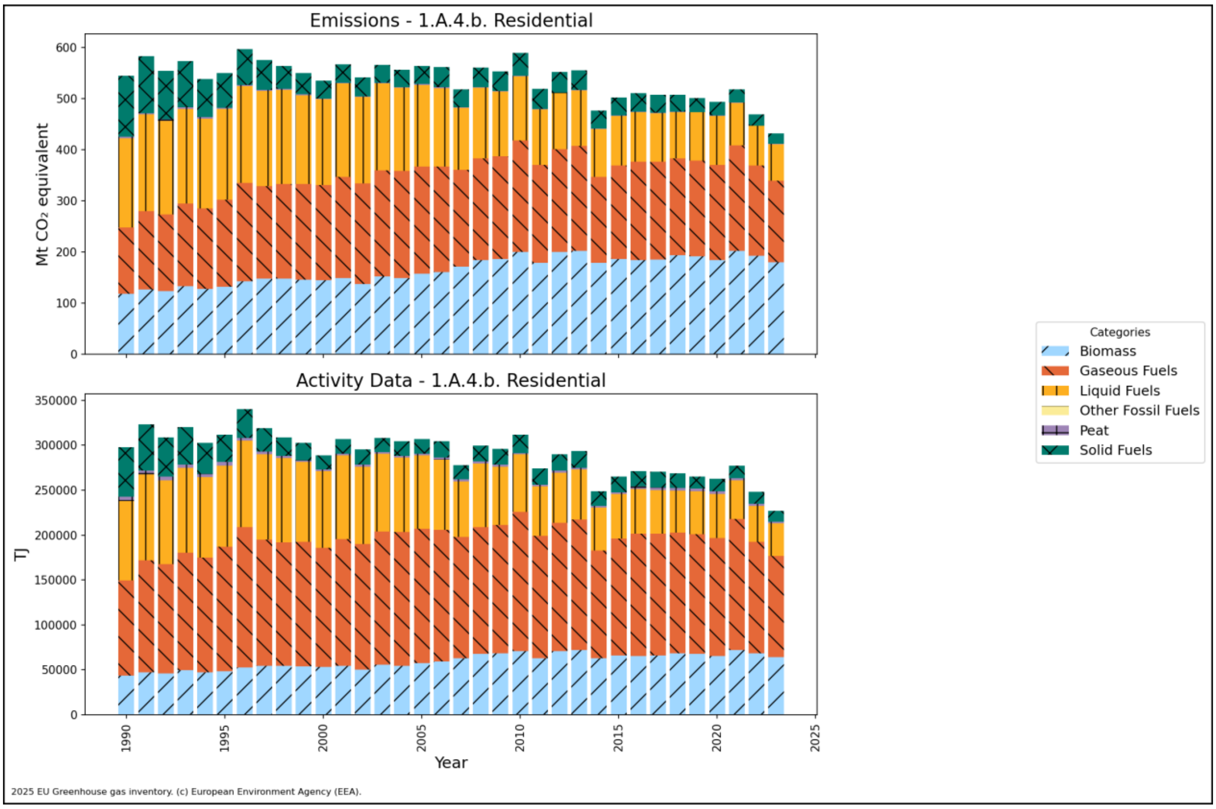
Almost of the Member States experienced decreasing trend in heating degree days due to the mild winter. Nevertheless, for most of the Member States trend in fuel consumption correlates with trend in heating degree days. The following Table 3.82: EU heating degree days 2021 and 2022 and 1.A.4.b trend in total fuel consumption. presents the (15°/18°) heating degree days in 2022 and 2023 for Member States and trend in 1.A.4.b total fuel consumption. Not only the mild winter but also higher prices due to the war in Ukraine have affected the consumption.

Table 3.82: EU heating degree days 2021 and 2022 and 1.A.4.b trend in total fuel consumption.

	2022	2023	Trend 2022 – 2023 [%]	Trend fuel consumption 1.A.4.b [%]
Austria	3 229	3 148	-81	-22
Belgium	2 390	2 363	-27	-28
Bulgaria	2 307	2 081	-226	-24
Croatia	2 114	1 958	-156	-8
Cyprus	696	530	-166	6
Czechia	3 083	2 922	-161	-34
Denmark	3 019	3 034	15	-39
Estonia	4 117	3 985	-132	3
Finland	5 277	5 437	160	-33
France	2 036	2 045	9	-35
Germany	2 736	2 661	-75	-19
Greece	1 538	1 376	-162	-11
Hungary	2 550	2 324	-226	-29
Ireland	2 549	2 397	-152	-7
Italy	1 735	1 689	-46	-14
Latvia	4 012	3 755	-257	-31
Lithuania	3 773	3 462	-311	-25
Luxembourg	2 785	2 732	-53	51
Malta	544	393	-151	-64
Netherlands	2 396	2 318	-78	-41
Poland	3 201	2 973	-228	18
Portugal	968	1 047	79	-32
Romania	2 751	2 507	-244	52
Slovakia	3 043	2 842	-201	-24
Slovenia	2 642	2 490	-152	-12
Spain	1 478	1 482	4	5
Sweden	4 919	5 180	261	-68
EU (weighted)	2 858	2 821	-47	-14

Source: Eurostat and EEA 2025

Figure 3.126 1.A.4.b Residential: Total emission and activity trends



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CO_2 emissions from 1.A.4.b Residential

Between 1990 and 2023, CO_2 emissions from households decreased by 41% in the EU (Table 3.83). Main factors influencing CO_2 emissions from this source category are (1) outdoor temperature, (2) number and size of dwellings, (3) building codes, (4) thermal properties of building stock, (5) fuel split for heating and warm water, (6) use of renewable energy sources, e.g. biomass or solar panels, and (7) the use of district heating. Fuel consumption of households decreased by 12% between 1990 and 2023, with a fuel shift from coal and oil to natural gas and biomass. Overall, the recently mild winters are apparent on the lower amount of fuel combustion.

Table 3.83 1.A.4.b Residential: Member States' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	10 000	5 814	5 025	2.0%	-4 975	-50%	-789	-14%	NA,T2	CS,NA
Belgium	20 576	12 707	12 471	5.0%	-8 105	-39%	-236	-2%	CS,M,NA,T1,T2	CS,D,NA
Bulgaria	2 887	417	252	0.1%	-2 635	-91%	-165	-40%	NA,T1,T2	CS,D,NA
Croatia	2 029	1 466	1 416	0.6%	-612	-30%	-50	-3%	NA,T1	D,NA
Cyprus	300	316	270	0.1%	-30	-10%	-46	-15%	NA,T1	D,NA
Czechia	18 375	7 048	5 603	2.2%	-12 772	-70%	-1 445	-21%	NA,T1,T2	CS,D,NA
Denmark	4 996	1 062	943	0.4%	-4 053	-81%	-119	-11%	NA,T2,T3	CS,D,NA
Estonia	1 021	122	152	0.1%	-869	-85%	31	25%	T1,T2	CS,D
Finland	3 148	641	385	0.2%	-2 763	-88%	-257	-40%	NA,T2,T3	CS,NA
France	53 936	32 778	29 571	11.8%	-24 366	-45%	-3 207	-10%	T1,T2	CS,D,OTH,PS
Germany	128 636	83 857	77 945	31.0%	-50 691	-39%	-5 912	-7%	-	-
Greece	4 654	5 023	3 595	1.4%	-1 059	-23%	-1 428	-28%	NA,T2	CS,NA
Hungary	15 448	7 137	6 208	2.5%	-9 240	-60%	-928	-13%	NA,T1,T2	CS,D,NA
Ireland	7 050	5 616	5 228	2.1%	-1 822	-26%	-388	-7%	NA,T2	CS,NA
Italy	55 788	41 775	36 507	14.5%	-19 281	-35%	-5 268	-13%	NA,T2	CS,NA
Latvia	1 182	408	385	0.2%	-797	-67%	-23	-6%	NA,T2	CS,NA
Lithuania	2 361	801	747	0.3%	-1 614	-68%	-54	-7%	NA,T2	CS,NA
Luxembourg	670	909	906	0.4%	236	35%	-2	0%	NA,T1,T2	CS,D,NA
Malta	95	32	30	0.0%	-66	-69%	-3	-8%	NA,T1	D,NA
Netherlands	20 809	13 476	11 375	4.5%	-9 434	-45%	-2 102	-16%	NA,T1,T2	CS,D,NA
Poland	35 222	28 014	27 578	11.0%	-7 644	-22%	-436	-2%	NA,T1,T2	CS,D,NA
Portugal	1 640	1 587	1 288	0.5%	-352	-21%	-300	-19%	NA	NA
Romania	8 871	7 197	6 903	2.7%	-1 968	-22%	-294	-4%	NA,T1,T2	CS,D,NA
Slovakia	6 773	2 869	2 611	1.0%	-4 162	-61%	-258	-9%	NA,T2	CS,NA
Slovenia	898	616	564	0.2%	-334	-37%	-52	-8%	NA,T1,T2	CS,D,NA
Spain	12 802	14 263	13 272	5.3%	471	4%	-991	-7%	NA,T2	CS,D,NA
Sweden	6 286	364	357	0.1%	-5 929	-94%	-7	-2%	T2	CS
EU-27	**426 454**	**276 316**	**251 588**	**100%**	**-174 866**	**-41%**	**-24 728**	**-9%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.4.b Residential – Liquid Fuels (CO_2)

In 2023 CO_2 from liquid fuels had a share of 26% CO_2 emissions within source category 1.A.4.b (compared to 36% in 1990). Between 1990 and 2023, emissions decreased by 59% (Table 3.84). Between 2022 and 2023 EU CO_2 emissions decreased by 8%.

Table 3.84 1.A.4.b Residential, liquid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	5 633	2 767	2 261	3.2%	-3 372	-60%	-507	-18%
Belgium	12 918	5 781	5 704	8.0%	-7 214	-56%	-78	-1%
Bulgaria	158	48	34	0.0%	-123	-78%	-14	-29%
Croatia	1 137	312	286	0.4%	-851	-75%	-26	-8%
Cyprus	300	316	270	0.4%	-30	-10%	-46	-15%
Czechia	239	130	154	0.2%	-85	-35%	24	19%
Denmark	3 937	314	274	0.4%	-3 663	-93%	-40	-13%
Estonia	244	9	27	0.0%	-218	-89%	18	199%
Finland	3 024	584	361	0.5%	-2 663	-88%	-223	-38%
France	30 915	10 815	9 596	13.5%	-21 319	-69%	-1 219	-11%
Germany	56 382	32 341	30 355	42.8%	-26 027	-46%	-1 986	-6%
Greece	4 565	3 916	2 721	3.8%	-1 845	-40%	-1 195	-31%
Hungary	3 540	194	188	0.3%	-3 352	-95%	-6	-3%
Ireland	1 173	3 137	3 122	4.4%	1 949	166%	-15	0%
Italy	28 444	4 838	4 586	6.5%	-23 858	-84%	-252	-5%
Latvia	332	160	188	0.3%	-144	-43%	29	18%
Lithuania	397	179	236	0.3%	-161	-41%	57	32%
Luxembourg	474	402	419	0.6%	-55	-12%	16	4%
Malta	95	32	30	0.0%	-66	-69%	-3	-8%
Netherlands	854	169	166	0.2%	-688	-81%	-3	-2%
Poland	110	1 615	1 505	2.1%	1 394	1263%	-110	-7%
Portugal	1 640	955	693	1.0%	-947	-58%	-261	-27%
Romania	922	813	712	1.0%	-210	-23%	-101	-12%
Slovakia	93	20	17	0.0%	-75	-81%	-3	-14%
Slovenia	528	375	368	0.5%	-160	-30%	-8	-2%
Spain	9 855	6 967	6 433	9.1%	-3 422	-35%	-534	-8%
Sweden	6 200	300	292	0.4%	-5 908	-95%	-8	-3%
EU-27	**174 109**	**77 489**	**70 997**	**100%**	**-103 113**	**-59%**	**-6 492**	**-8%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.127 and Figure 3.128 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Fuel consumption in the EU decreased by 59% between 1990 and 2023. The CO_2 implied emission factor for liquid fuels was 72.02 t/TJ in 2023. Within the MS there is variation of specific fuels used, which is causing also the fluctuation of the IEF. Most often Residual fuel oil, LPG and other kerosene are used.

Figure 3.127 1.A.4.b Residential, liquid fuels: Emission trend and share for CO_2

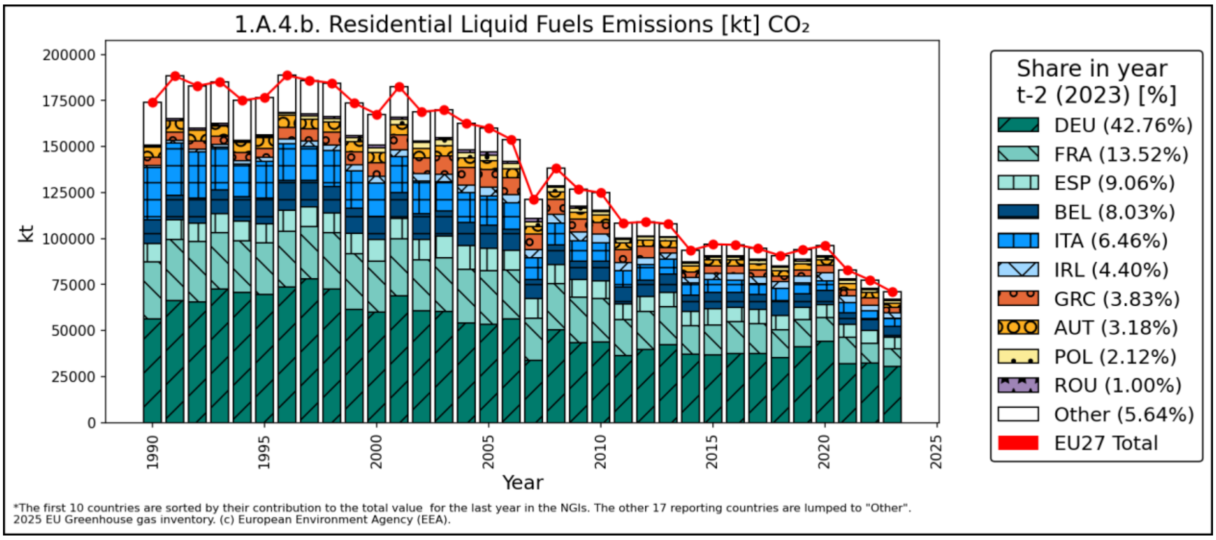
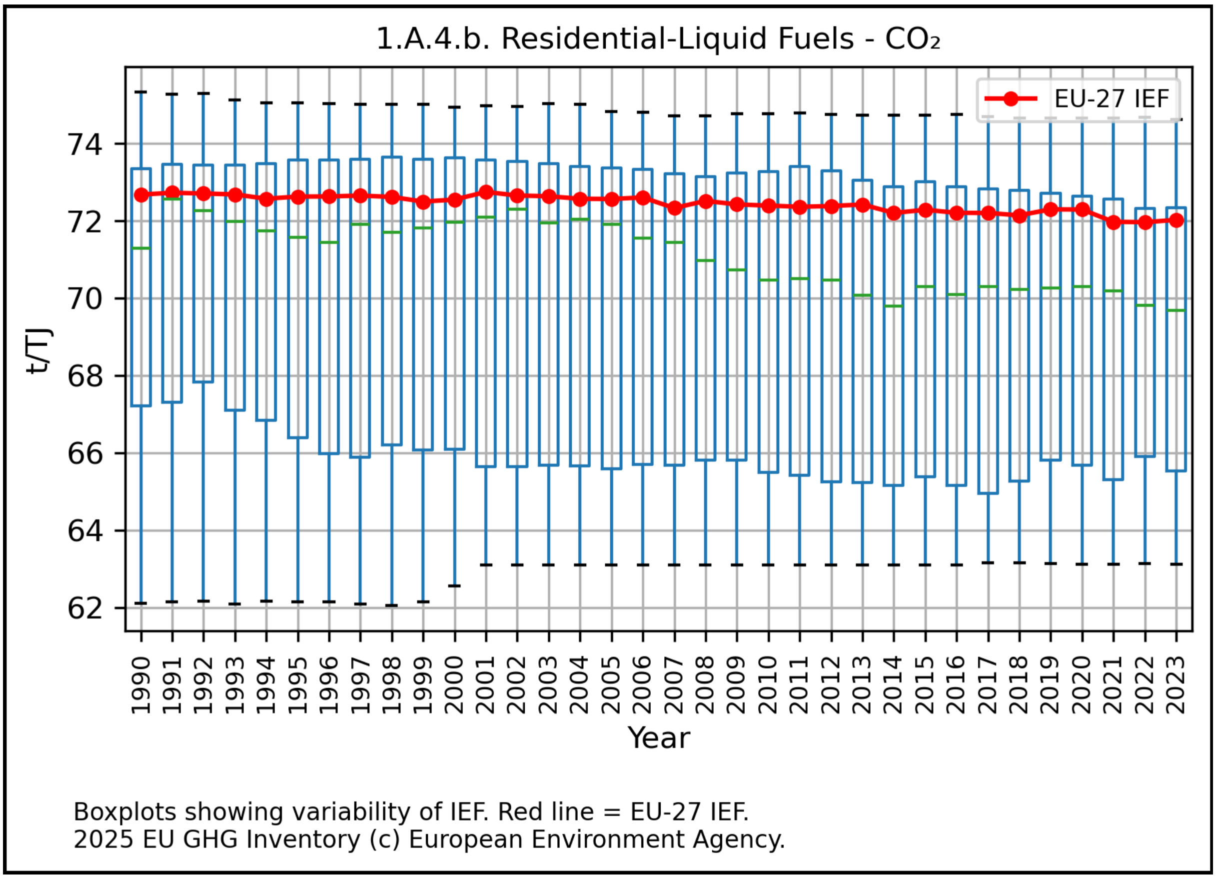


Figure 3.128 1.A.4.b Residential, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.b Residential –Solid Fuels (CO_2)

In 2023, CO_2 from solid fuels had a share of 8% CO_2 emissions within source category 1.A.4.b (compared to 27% in 1990). Between 1990 and 2023 CO_2 emissions decreased by 83% (Table 3.85). Between 2022 and 2023 CO_2 emissions decreased by 8%. According to the methodology as described in chapter 3.6.4 98% of EU emissions are calculated by using higher tier methods in 2023.

Table 3.85 1.A.4.b Residential, solid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	2 511	33	27	0.1%	-2 483	-99%	-6	-18%
Belgium	1 796	68	59	0.3%	-1 737	-97%	-9	-13%
Bulgaria	2 730	166	53	0.3%	-2 677	-98%	-113	-68%
Croatia	436	6	4	0.0%	-432	-99%	-1	-25%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	16 038	3 026	1 957	9.6%	-14 081	-88%	-1 069	-35%
Denmark	72	NO	NO	-	-72	-100%	-	-
Estonia	337	NO	1	0.0%	-336	-100%	1	∞
Finland	33	NO	NO	-	-33	-100%	-	-
France	1 957	105	77	0.4%	-1 880	-96%	-28	-27%
Germany	40 661	1 219	1 154	5.7%	-39 506	-97%	-64	-5%
Greece	89	20	16	0.1%	-72	-81%	-4	-18%
Hungary	8 083	209	136	0.7%	-7 947	-98%	-73	-35%
Ireland	2 483	507	398	1.9%	-2 085	-84%	-109	-22%
Italy	899	NO	NO	-	-899	-100%	-	-
Latvia	587	5	5	0.0%	-582	-99%	0	-8%
Lithuania	1 440	105	55	0.3%	-1 385	-96%	-50	-48%
Luxembourg	26	4	1	0.0%	-25	-96%	-3	-76%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	61	0	0	0.0%	-61	-100%	0	-10%
Poland	28 362	16 290	16 186	79.2%	-12 176	-43%	-104	-1%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	2 729	147	155	0.8%	-2 575	-94%	8	5%
Slovakia	5 122	236	147	0.7%	-4 975	-97%	-89	-38%
Slovenia	345	NO	NO	-	-345	-100%	-	-
Spain	2 035	6	NO	-	-2 035	-100%	-6	-100%
Sweden	NO	NO	NO	-	-	-	-	-
EU-27	**118 831**	**22 152**	**20 431**	**100%**	**-98 400**	**-83%**	**-1 721**	**-8%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.129 and Figure 3.130 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Fuel consumption in the EU decreased by 78% between 1990 and 2023. The CO_2 implied emission factor for solid fuels was 94.58 t/TJ in 2023.

Figure 3.129 1.A.4.b Residential, solid fuels: Emission trend and share for CO_2

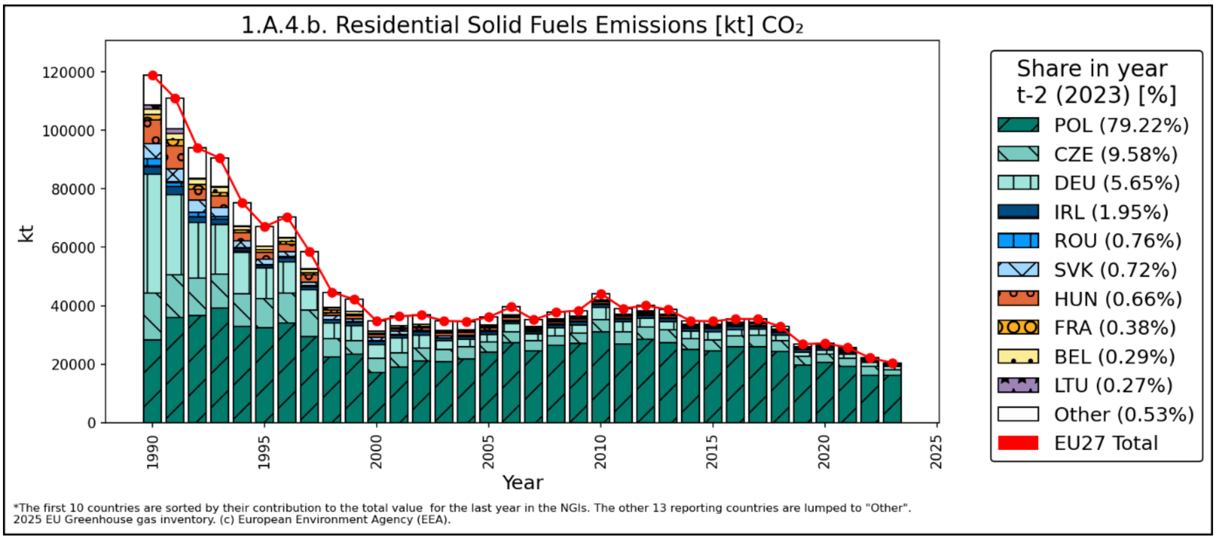
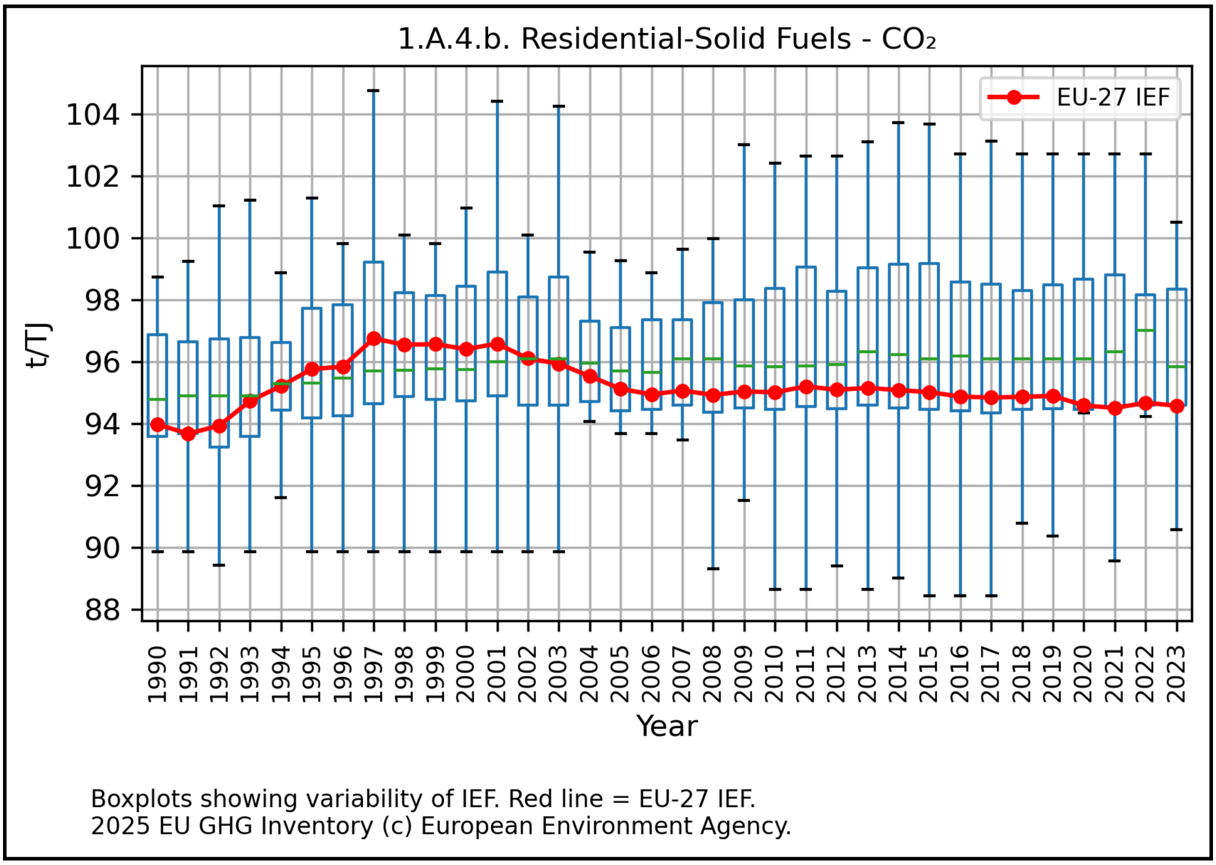


Figure 3.130 1.A.4.b Residential, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.b Residential – Gaseous Fuels (CO_2)

In 2023, CO_2 from gaseous fuels had a share of 59% CO_2 emissions within source category 1.A.4.b (compared to 37% in 1990). Between 1990 and 2023, the emissions increased by 23% (Table 3.86). Between 2022 and 2023 EU emissions decreased by 9%.

Table 3.86 1.A.4.b Residential, gaseous fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	1 856	3 013	2 736	1.7%	881	47%	-276	-9%
Belgium	5 862	6 858	6 709	4.2%	847	14%	-149	-2%
Bulgaria	NO	203	165	0.1%	165	∞	-38	-19%
Croatia	456	1 149	1 127	0.7%	671	147%	-22	-2%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	2 098	3 892	3 491	2.2%	1 393	66%	-401	-10%
Denmark	988	748	669	0.4%	-319	-32%	-79	-11%
Estonia	132	113	125	0.1%	-7	-5%	12	11%
Finland	25	43	20	0.0%	-5	-21%	-24	-54%
France	21 064	21 846	19 890	12.5%	-1 174	-6%	-1 956	-9%
Germany	31 564	50 297	46 435	29.1%	14 871	47%	-3 861	-8%
Greece	NO	1 088	858	0.5%	858	∞	-230	-21%
Hungary	3 825	6 734	5 885	3.7%	2 059	54%	-849	-13%
Ireland	270	1 279	1 102	0.7%	832	309%	-177	-14%
Italy	26 444	36 938	31 921	20.0%	5 476	21%	-5 017	-14%
Latvia	221	243	192	0.1%	-29	-13%	-51	-21%
Lithuania	509	458	423	0.3%	-86	-17%	-35	-8%
Luxembourg	170	502	487	0.3%	317	187%	-15	-3%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	19 894	13 307	11 209	7.0%	-8 685	-44%	-2 098	-16%
Poland	6 750	10 110	9 888	6.2%	3 138	46%	-222	-2%
Portugal	NO	633	594	0.4%	594	∞	-38	-6%
Romania	5 220	6 237	6 036	3.8%	816	16%	-201	-3%
Slovakia	1 559	2 613	2 447	1.5%	888	57%	-166	-6%
Slovenia	25	240	196	0.1%	171	677%	-44	-18%
Spain	912	7 291	6 840	4.3%	5 928	650%	-451	-6%
Sweden	86	64	65	0.0%	-21	-25%	1	1%
EU-27	**129 929**	**175 897**	**159 508**	**100%**	**29 579**	**23%**	**-16 389**	**-9%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.131 shows CO_2 emissions for EU and the Member States as well as the share of the Member States with the highest contributions. Fuel consumption in the EU increased by 7% between 1990 and 2023. The CO_2 implied emission factor for gaseous fuels was 56.73 t/TJ in 2023.

Figure 3.131 1.A.4.b Residential, gaseous fuels: Emission trend and share for CO_2

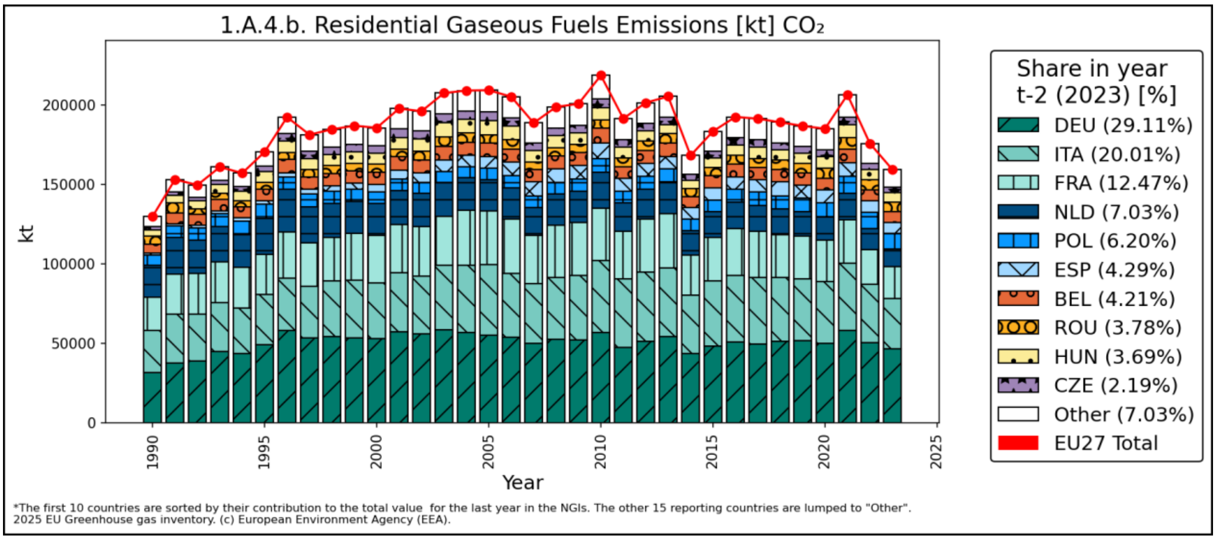
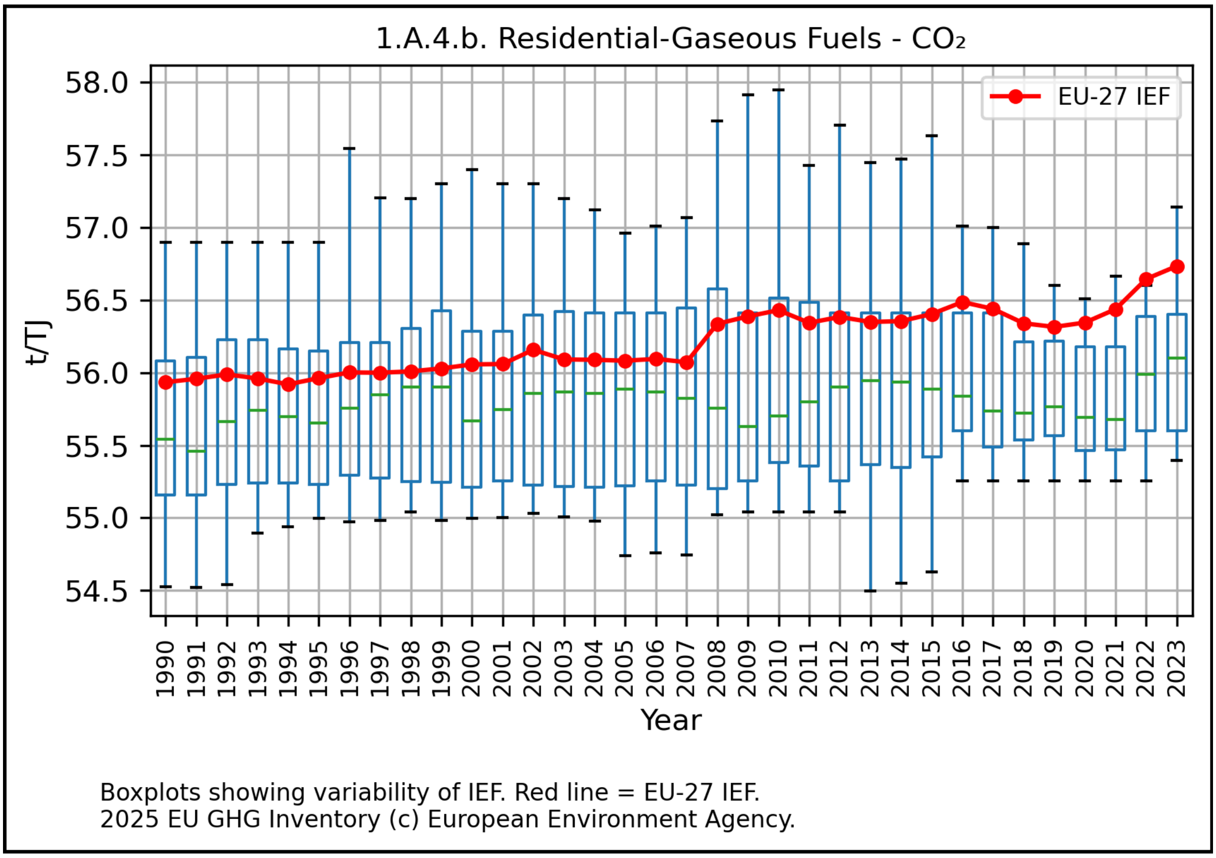


Figure 3.132 1.A.4.b Residential, gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



CH_4 emissions from 1.A.4.b Residential

CH_4 emissions mainly occur from incomplete biomass and coal combustion. CH_4 emissions from 1.A.4.b Residential accounted for 59% of total CH_4 emissions in 1.A and 0.6% of total GHG emissions in 1.A in 2023. Between 1990 and 2023, CH_4 emissions from households decreased by 33% in the EU (Table 3.87). Between 2022 and 2023 CH_4 emissions decreased by 7%.

Table 3.87 1.A.4.b Residential: Member States' contributions to CH_4 emissions and information on method applied and emission factor

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	514	218	209	1.5%	-304	-59%	-8	-4%	NA,T1,T2,T3	CS,D,NA
Belgium	263	282	290	2.1%	28	11%	9	3%	CS,M,NA,T1	CR,D,NA
Bulgaria	293	241	211	1.5%	-83	-28%	-30	-12%	NA,T1	D,NA
Croatia	396	358	346	2.5%	-50	-13%	-12	-3%	NA,T1	D,NA
Cyprus	2	8	7	0.0%	5	221%	-1	-14%	NA,T1	D,NA
Czechia	1 697	1 038	861	6.2%	-836	-49%	-177	-17%	NA,T1	D,NA
Denmark	152	81	81	0.6%	-71	-46%	0	0%	NA,T3	CS,D,M,NA,OTH
Estonia	64	15	13	0.1%	-51	-79%	-1	-9%	T1,T2	CS,D
Finland	166	183	176	1.3%	10	6%	-7	-4%	NA,T1,T2,T3	CR,CS,D,NA
France	5 111	1 996	1 885	13.6%	-3 226	-63%	-111	-6%	T1,T2	CS,D
Germany	2 783	1 041	843	6.1%	-1 939	-70%	-197	-19%	-	-
Greece	256	240	252	1.8%	-4	-2%	12	5%	NA,T1	D,NA
Hungary	925	486	456	3.3%	-469	-51%	-30	-6%	NA,T1	D,NA
Ireland	496	124	107	0.8%	-389	-78%	-17	-14%	NA,T1	D,NA
Italy	1 226	2 364	2 293	16.5%	1 067	87%	-71	-3%	NA,T2	CR,NA
Latvia	221	122	121	0.9%	-100	-45%	-2	-1%	NA,T1,T2	CS,D,NA
Lithuania	196	99	84	0.6%	-112	-57%	-15	-15%	NA,T1,T2	CS,D,NA
Luxembourg	10	11	13	0.1%	2	23%	2	17%	NA,T1,T3	D,M,NA
Malta	0	0	0	0.0%	0	26%	0	-21%	NA,T1	D,NA
Netherlands	504	342	300	2.2%	-204	-40%	-43	-12%	NA,T1,T2	CS,D,NA
Poland	2 772	3 202	3 010	21.7%	238	9%	-192	-6%	NA,T1	D,NA
Portugal	479	236	240	1.7%	-240	-50%	4	2%	NA	NA
Romania	457	1 114	1 066	7.7%	609	133%	-47	-4%	NA,T1	D,NA
Slovakia	424	200	170	1.2%	-254	-60%	-30	-15%	NA,T1	D,NA
Slovenia	159	108	95	0.7%	-64	-40%	-12	-12%	NA,T1,T2	CS,D,NA
Spain	889	684	683	4.9%	-206	-23%	0	0%	NA,T2	D,NA
Sweden	115	53	52	0.4%	-63	-55%	-1	-2%	M,T2	CS
EU-27	**20 572**	**14 843**	**13 865**	**100%**	**-6 706**	**-33%**	**-978**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.4.b Residential – Biomass (CH_4)

In 2023 CH_4 from biomass had a share of 82% within source category on the total CH_4 emissions from 1.A.4.b (compared to 47% in 1990). Between 1990 and 2023 CH_4 emissions increased by 9% (Table 3.88). Between 2022 and 2023, CH_4 emissions decreased by 6%.

Table 3.88 1.A.4.b Residential, biomass: Member States' contributions to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	264	203	196	1.7%	-68	-26%	-7	-3%
Belgium	109	256	266	2.3%	156	143%	10	4%
Bulgaria	61	225	205	1.8%	145	239%	-20	-9%
Croatia	354	353	342	3.0%	-12	-3%	-11	-3%
Cyprus	1	7	6	0.1%	5	423%	-1	-14%
Czechia	363	758	679	6.0%	315	87%	-80	-11%
Denmark	124	66	68	0.6%	-56	-45%	2	3%
Estonia	6	14	13	0.1%	6	99%	-2	-11%
Finland	147	177	171	1.5%	24	16%	-6	-3%
France	4 764	1 881	1 782	15.7%	-2 981	-63%	-99	-5%
Germany	313	868	687	6.0%	374	119%	-181	-21%
Greece	247	236	249	2.2%	2	1%	13	5%
Hungary	209	450	428	3.8%	219	105%	-21	-5%
Ireland	16	9	9	0.1%	-7	-41%	0	1%
Italy	1 115	2 314	2 250	19.8%	1 134	102%	-64	-3%
Latvia	162	120	119	1.0%	-44	-27%	-2	-1%
Lithuania	66	84	75	0.7%	10	15%	-9	-10%
Luxembourg	5	8	10	0.1%	4	80%	2	28%
Malta	NO	0	0	0.0%	0	∞	0	-23%
Netherlands	99	72	70	0.6%	-29	-29%	-2	-3%
Poland	327	1 723	1 539	13.5%	1 213	371%	-184	-11%
Portugal	476	234	238	2.1%	-238	-50%	4	2%
Romania	202	1 080	1 033	9.1%	831	410%	-47	-4%
Slovakia	40	174	152	1.3%	111	277%	-22	-13%
Slovenia	129	106	93	0.8%	-36	-28%	-12	-12%
Spain	729	643	645	5.7%	-84	-12%	3	0%
Sweden	107	51	50	0.4%	-58	-54%	-1	-1%
EU-27	**10 436**	**12 112**	**11 375**	**100%**	**939**	**9%**	**-737**	**-6%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviation'.

Figure 3.133 and Figure 3.134 show CH_4 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Biomass fuel consumption in the EU increased by 47% between 1990 and 2023. The CH_4 implied emission factor for biomass fuels was 234.99 kg/TJ in 2023.

The decreasing trend of IEF reflects replacement of old biomass boilers, stoves and open fireplaces by modern technologies (pellets, automatic boilers). These new technologies have lower CH_4 (as well as NMVOC) emissions from incomplete combustion. However, this change in improved technologies is not reflected by the Member States that are using the default emission factor value (300 kg/TJ) for the whole time series.

Figure 3.133 1.A.4.b Residential, biomass: Emission trend and share for CH_4

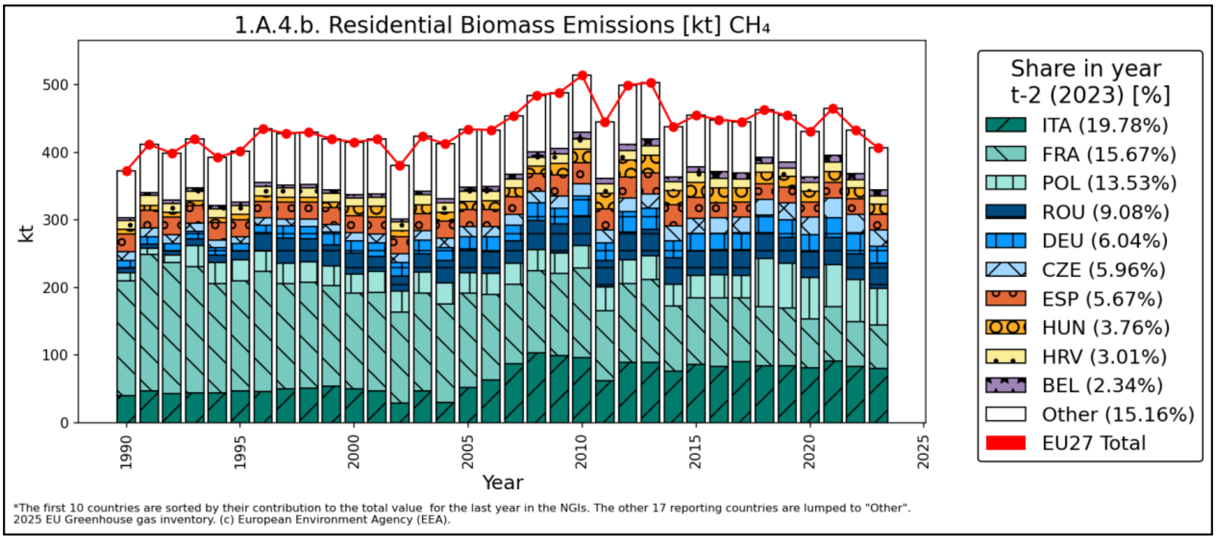
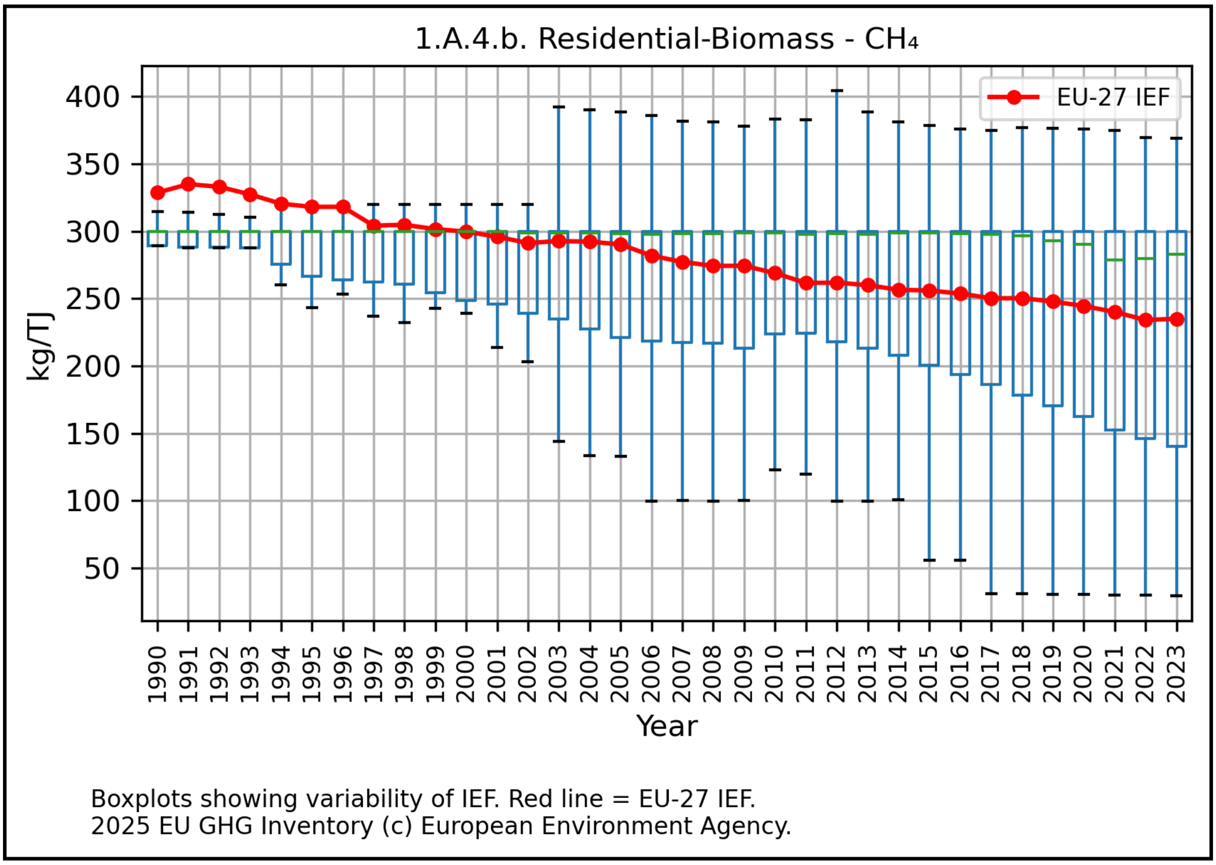


Figure 3.134 1.A.4.b Residential, biomass: Implied Emission Factors for CH_4 (in kg/TJ)



1.A.4.b Residential – Solid Fuels (CH_4)

In 2023, CH_4 from solid fuels had a share of 13% within source category on the total CH_4 emissions from 1.A.4.b (compared to 46% in 1990). Between 1990 and 2023 CH_4 emissions decreased by 80% (Table 3.88). All Member States reported decreasing emissions since 1990. Between 2022 and 2023 CH_4 emissions decreased by 8%.

Table 3.89: 1.A.4.b Residential, solid fuels: Member States' contributions to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	224	3	2	0.1%	-221	-99%	-1	-18%
Belgium	123	5	4	0.2%	-119	-97%	-1	-15%
Bulgaria	232	15	5	0.3%	-227	-98%	-10	-67%
Croatia	37	0	0	0.0%	-37	-99%	0	-25%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	1 328	269	173	9.7%	-1 155	-87%	-96	-36%
Denmark	6	NO	NO	-	-6	-100%	-	-
Estonia	30	NO	0	0.0%	-29	-100%	0	∞
Finland	3	NO	NO	-	-3	-100%	-	-
France	174	9	7	0.4%	-167	-96%	-3	-27%
Germany	2 429	90	80	4.4%	-2 349	-97%	-10	-11%
Greece	8	2	1	0.1%	-7	-82%	0	-18%
Hungary	693	17	11	0.6%	-682	-98%	-6	-35%
Ireland	220	44	34	1.9%	-186	-85%	-10	-22%
Italy	11	NO	NO	-	-11	-100%	-	-
Latvia	54	0	0	0.0%	-53	-99%	0	-8%
Lithuania	127	9	5	0.3%	-123	-96%	-4	-48%
Luxembourg	2	0	0	0.0%	-2	-96%	0	-76%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	0	0	0	0.0%	0	-100%	0	-9%
Poland	2 428	1 449	1 442	80.4%	-986	-41%	-7	0%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	239	16	16	0.9%	-223	-93%	1	3%
Slovakia	379	20	12	0.7%	-367	-97%	-8	-38%
Slovenia	28	NO	NO	-	-28	-100%	-	-
Spain	130	1	NO	-	-130	-100%	-1	-100%
Sweden	NO	NO	NO	-	-	-	-	-
EU-27	**8 905**	**1 949**	**1 795**	**100%**	**-7 110**	**-80%**	**-154**	**-8%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.133 and Figure 3.134 show CH_4 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Solid fuel consumption in the EU decreased by 78% between 1990 and 2023. The CH_4 implied emission factor for solid fuels was 296.70 kg/TJ in 2023.

Figure 3.135: 1.A.4.b Residential, solid fuels: Emission trend and share for CH_4

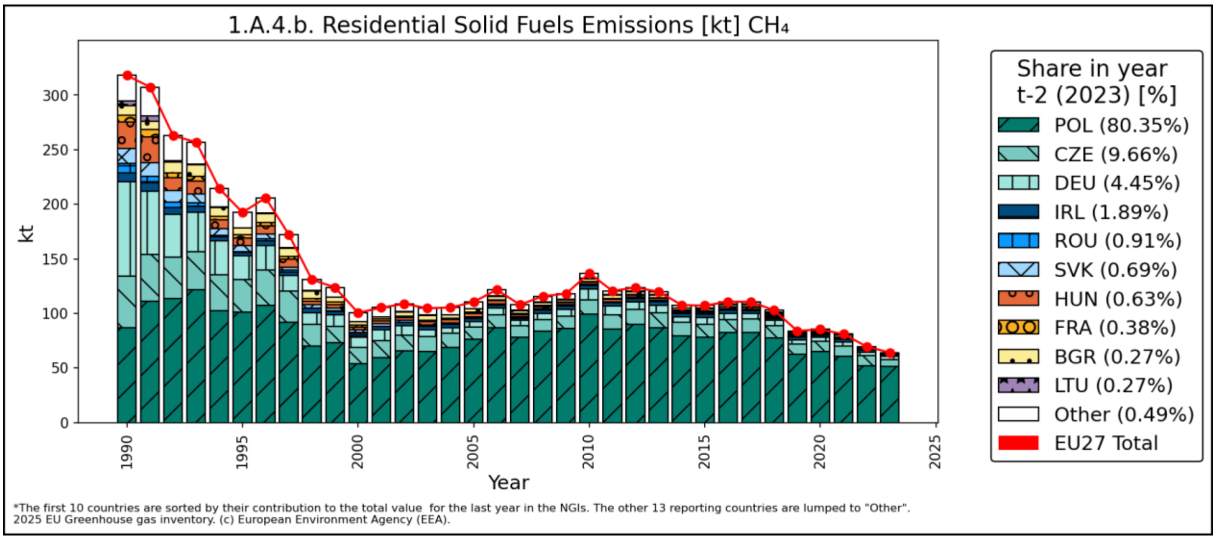
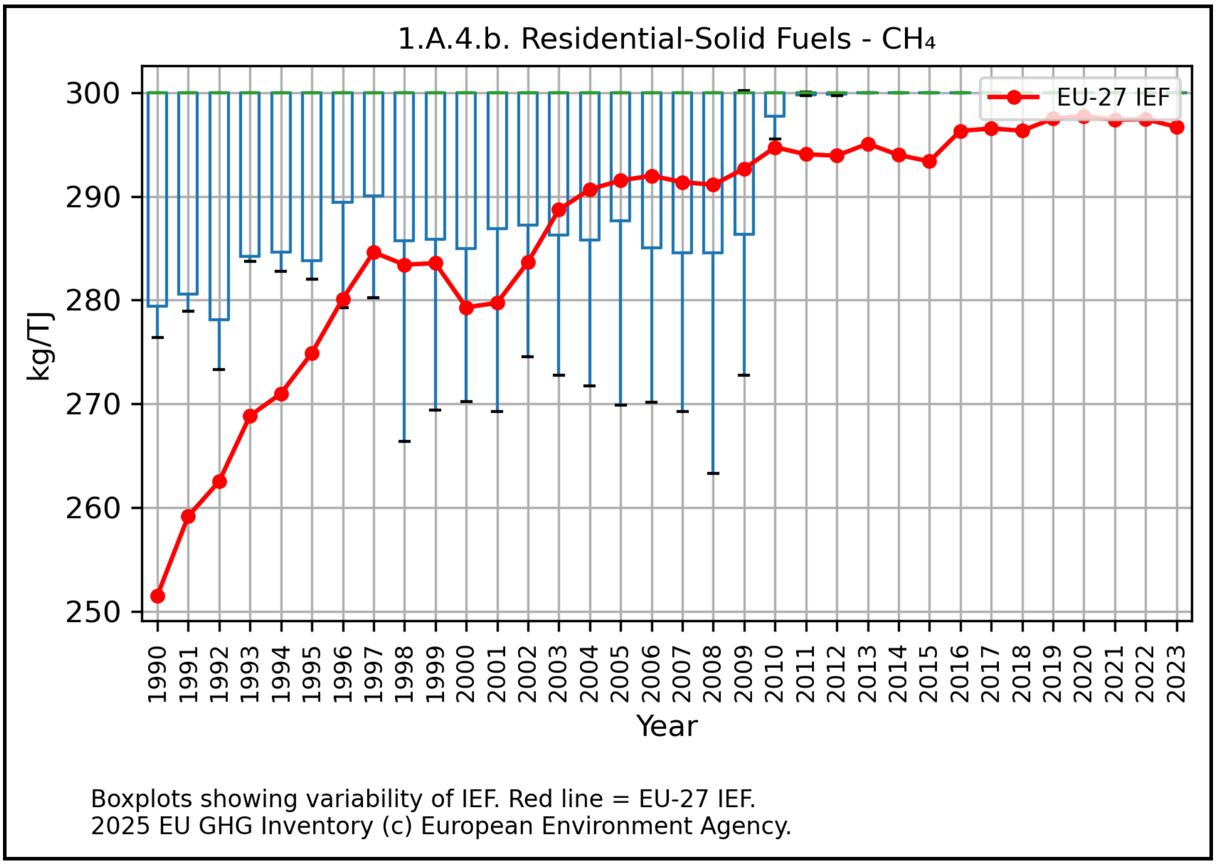


Table 3.90: 1.A.4.b Residential, solid fuels: Implied Emission Factors for CH_4 (in kg/TJ)



3.6.4.3 Agriculture/Forestry/Fisheries (1.A.4.c)

In this chapter informations about emission trends, Member States' contribution and activity data is provided for category 1.A.4.c, by fuels. CO_2 emissions from 1.A.4.c Agriculture/Forestry/Fisheries accounted for 3.1% of total EU GHG emissions from 1.A Fuel Combustion in 2023. Between 1990 and 2023, CO_2 emissions from 1.A.4.c Agriculture/Forestry/Fisheries decreased by 20% in the EU (Table 3.91).

Figure 3.136 shows the emission trend within source category 1.A.4.c, which is mainly dominated by CO_2 emissions from liquid fuels. Total GHG emissions in this subcategory decreased by 14% between 1990 and 2023, mainly due to decreases in CO_2 emissions from liquid fuels.

Figure 3.136 1.A.4.c Agriculture/Forestry/Fisheries: Total emission and activity trends

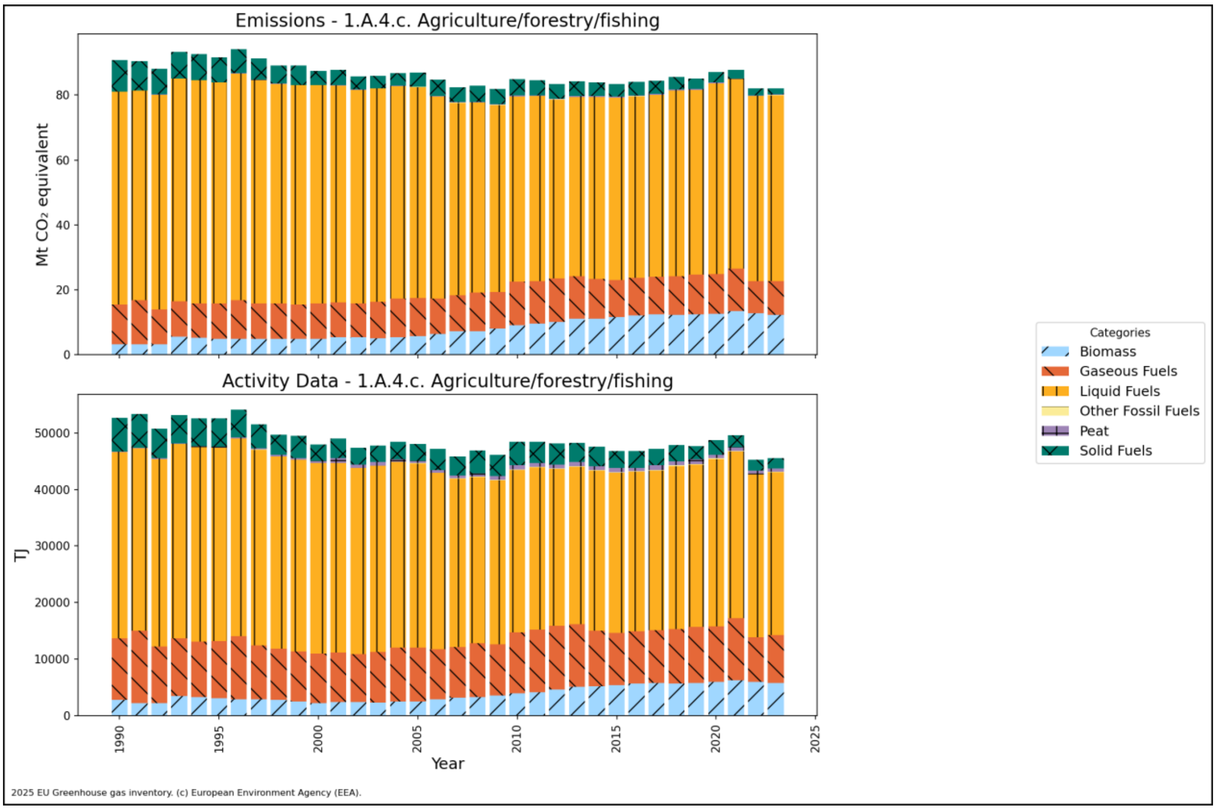


Table 3.91 1.A.4.c Agriculture/Forestry/Fisheries: Member States' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	1 251	850	820	1.2%	-431	-34%	-30	-4%	NA,T2	CS,NA
Belgium	3 037	2 198	2 342	3.4%	-695	-23%	144	7%	CS,M,NA,T1,T2	CS,D,NA
Bulgaria	1 649	477	456	0.7%	-1 193	-72%	-20	-4%	NA,T1,T2	CS,D,NA
Croatia	835	693	687	1.0%	-149	-18%	-6	-1%	NA,T1	D,NA
Cyprus	55	81	72	0.1%	17	30%	-9	-11%	NA,T1	D,NA
Czechia	3 673	1 156	1 145	1.6%	-2 528	-69%	-12	-1%	NA,T1,T2	CS,D,NA
Denmark	2 204	1 457	1 385	2.0%	-819	-37%	-72	-5%	NA,T2,T3	CS,D,NA
Estonia	532	89	64	0.1%	-468	-88%	-25	-28%	NA,T1,T2	CS,D,NA
Finland	1 870	1 400	1 309	1.9%	-561	-30%	-92	-7%	NA,T1,T2,T3	CS,NA
France	11 226	10 379	10 030	14.4%	-1 196	-11%	-349	-3%	NA,T1,T2	,D,NA,OTH,PS
Germany	11 360	7 950	7 880	11.3%	-3 480	-31%	-70	-1%	CS,NA,T2,T3	CS,NA
Greece	2 893	589	500	0.7%	-2 393	-83%	-89	-15%	NA,T2	CS,NA
Hungary	2 706	1 343	1 278	1.8%	-1 428	-53%	-65	-5%	NA,T1,T2	CS,D,NA
Ireland	747	832	758	1.1%	11	1%	-74	-9%	NA,T1,T2	CS,D,NA
Italy	8 352	7 246	6 963	10.0%	-1 389	-17%	-282	-4%	NA,T2	CS,NA
Latvia	1 585	488	443	0.6%	-1 142	-72%	-45	-9%	NA,T1,T2	CS,D,NA
Lithuania	1 483	259	218	0.3%	-1 265	-85%	-41	-16%	NA,T2	CS,NA
Luxembourg	34	22	22	0.0%	-12	-34%	0	0%	NA,T1,T2	CS,D,NA
Malta	4	59	49	0.1%	45	1142%	-10	-17%	NA,T1	D,NA
Netherlands	9 874	6 836	7 317	10.5%	-2 557	-26%	481	7%	NA,T1,T2	CS,D,NA
Poland	8 505	8 859	9 771	14.0%	1 266	15%	912	10%	NA,T1,T2	CS,D,NA
Portugal	1 119	1 229	1 272	1.8%	153	14%	42	3%	NA,NO,T1,T2	CS,D,NA,NO
Romania	1 992	1 560	1 525	2.2%	-468	-23%	-36	-2%	NA,T1,T2	CS,D,NA
Slovakia	146	296	253	0.4%	107	73%	-42	-14%	NA,T1,T2	CS,NA
Slovenia	166	215	215	0.3%	49	30%	0	0%	NA,T1	D,NA
Spain	8 695	11 740	12 058	17.3%	3 363	39%	318	3%	CR,NA,T1,T2,T3	CR,CS,D,NA
Sweden	1 654	929	952	1.4%	-702	-42%	23	3%	NA,T2	CS,NA
EU-27	**87 648**	**69 234**	**69 784**	**100%**	**-17 864**	**-20%**	**551**	**1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.4.c Agriculture/Forestry/Fisheries – Liquid Fuels (CO_2)

In 2023, CO_2 from liquid fuels had a share of 82% within source category 1.A.4.c (compared to 76% in 1990). Between 1990 and 2023 CO_2 decreased by 13% (Table 3.92). Between 2022 and 2023 EU emissions increased very slightly.

Table 3.92 1.A.4.c Agriculture/Forestry/Fisheries, liquid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	1 180	799	791	1.4%	-389	-33%	-9	-1%
Belgium	2 758	1 037	1 012	1.8%	-1 746	-63%	-25	-2%
Bulgaria	1 498	408	404	0.7%	-1 094	-73%	-4	-1%
Croatia	788	633	635	1.1%	-153	-19%	2	0%
Cyprus	55	81	72	0.1%	17	30%	-9	-11%
Czechia	1 537	1 037	1 035	1.8%	-502	-33%	-2	0%
Denmark	1 841	1 413	1 349	2.4%	-492	-27%	-64	-5%
Estonia	504	84	61	0.1%	-444	-88%	-23	-27%
Finland	1 784	1 275	1 182	2.1%	-602	-34%	-92	-7%
France	10 905	9 960	9 648	16.9%	-1 257	-12%	-312	-3%
Germany	8 016	7 159	7 075	12.4%	-941	-12%	-84	-1%
Greece	2 882	585	497	0.9%	-2 385	-83%	-88	-15%
Hungary	2 084	1 118	1 080	1.9%	-1 004	-48%	-38	-3%
Ireland	747	832	758	1.3%	11	1%	-74	-9%
Italy	8 300	6 311	6 063	10.6%	-2 237	-27%	-248	-4%
Latvia	701	476	433	0.8%	-268	-38%	-43	-9%
Lithuania	1 173	203	169	0.3%	-1 004	-86%	-35	-17%
Luxembourg	34	22	22	0.0%	-12	-35%	0	0%
Malta	4	59	49	0.1%	45	1142%	-10	-17%
Netherlands	2 545	1 697	1 707	3.0%	-838	-33%	11	1%
Poland	4 725	6 849	7 938	13.9%	3 213	68%	1 089	16%
Portugal	1 119	1 212	1 252	2.2%	133	12%	39	3%
Romania	9	1 218	1 255	2.2%	1 245	13265%	37	3%
Slovakia	104	214	179	0.3%	75	72%	-35	-16%
Slovenia	166	215	215	0.4%	49	30%	0	0%
Spain	8 652	11 217	11 315	19.8%	2 663	31%	98	1%
Sweden	1 464	919	941	1.6%	-523	-36%	23	2%
EU-27	**65 576**	**57 032**	**57 137**	**100%**	**-8 439**	**-13%**	**105**	**0%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.137 and Figure 3.138 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Liquid fuel consumption in the EU decreased by 12% between 1990 and 2023. The CO_2 implied emission factor for liquid fuels was 73.44 t/TJ in 2023.

Figure 3.137 1.A.4.c Agriculture/Forestry/Fisheries, liquid fuels: Emission trend and share for CO_2

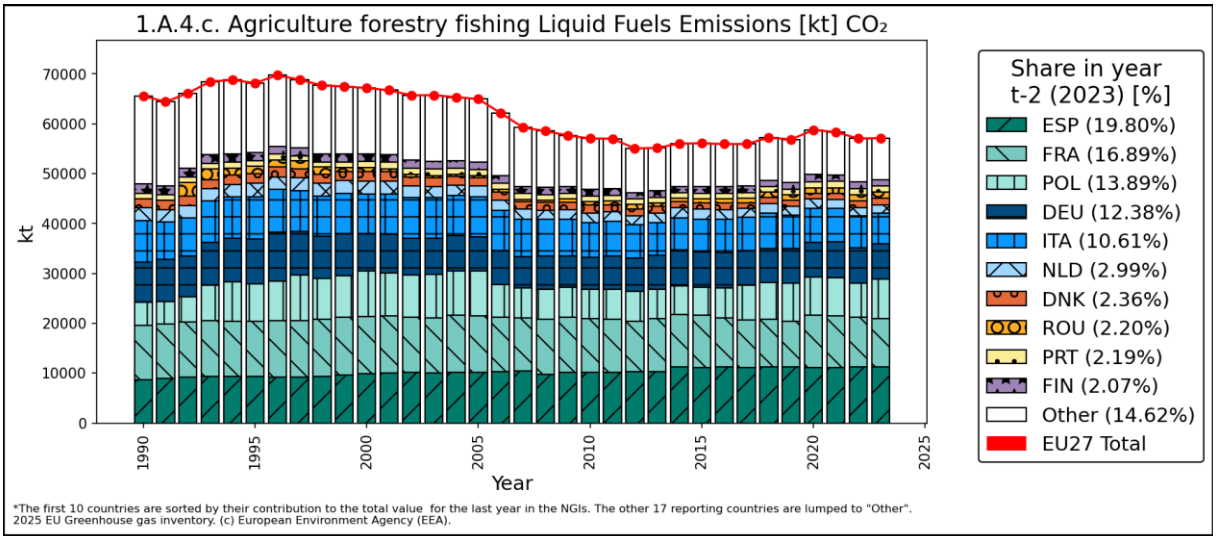
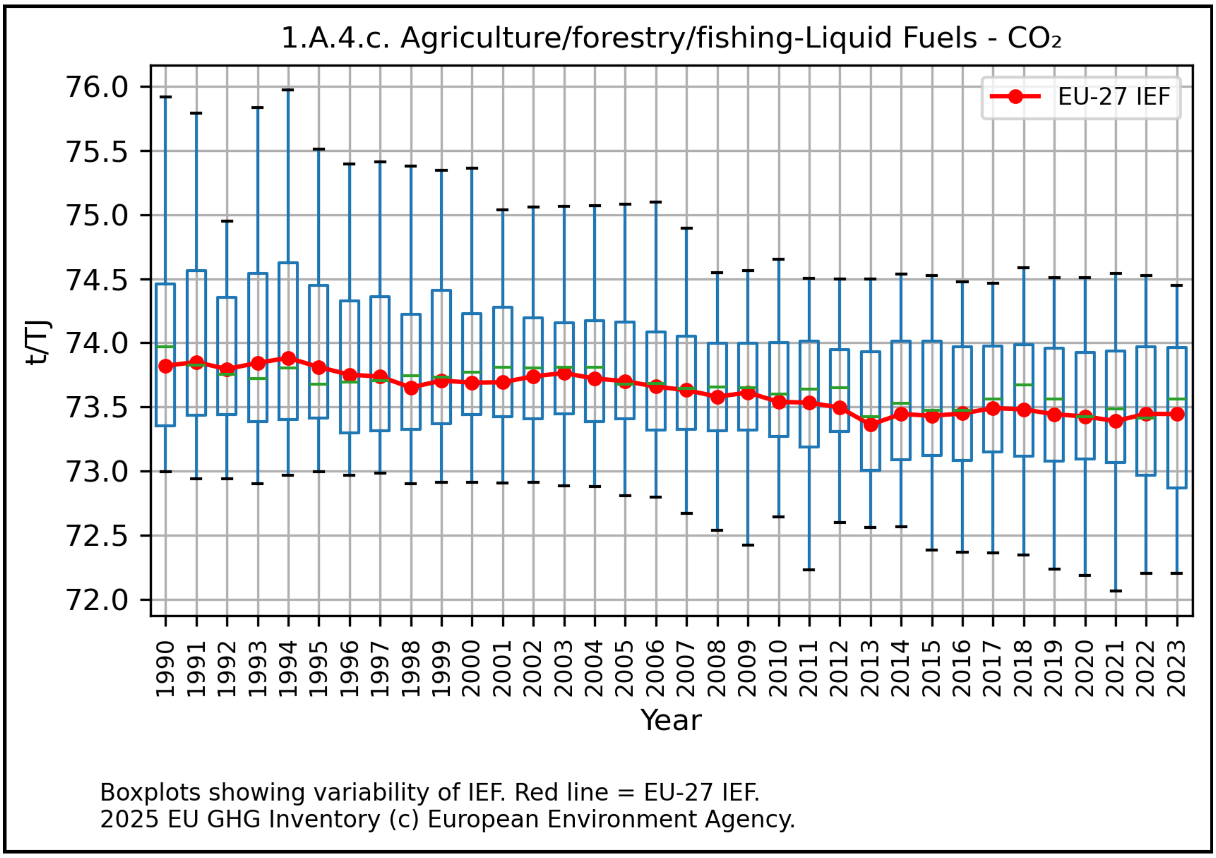


Figure 3.138 1.A.4.c Agriculture/Forestry/Fisheries, liquid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.c Agriculture/Forestry/Fisheries – Solid Fuels (CO_2)

In 2023 CO_2 from solid fuels had a share of 3% within source category 1.A.4.c (compared to 10% in 1990). Between 1990 and 2023, CO_2 decreased by 81% (Table 3.93). Between 2022 and 2023, EU emissions decreased by 11%.

Table 3.93 1.A.4.c Agriculture/Forestry/Fisheries, solid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	51	1	1	0.0%	-50	-99%	0	-23%
Belgium	212	23	23	1.2%	-189	-89%	0	0%
Bulgaria	151	45	30	1.6%	-121	-80%	-15	-34%
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	1 730	23	19	1.0%	-1 711	-99%	-4	-18%
Denmark	237	12	7	0.4%	-230	-97%	-5	-43%
Estonia	22	NO	NO	-	-22	-100%	-	-
Finland	13	7	6	0.3%	-7	-54%	-1	-16%
France	NO	NO	NO	-	-	-	-	-
Germany	2 861	NO	NO	-	-2 861	-100%	-	-
Greece	11	5	3	0.1%	-8	-74%	-2	-38%
Hungary	188	5	NO	-	-188	-100%	-5	-100%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	NO	NO	NO	-	-	-	-	-
Latvia	99	NO	NO	-	-99	-100%	-	-
Lithuania	148	7	1	0.1%	-146	-99%	-5	-79%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	NO	NO	NO	-	-	-	-	-
Poland	3 755	1 925	1 739	91.7%	-2 016	-54%	-186	-10%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	66	80	66	3.5%	0	0%	-14	-18%
Slovakia	1	1	1	0.0%	-1	-40%	0	-15%
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	37	NO	NO	-	-37	-100%	-	-
Sweden	157	NO	NO	-	-157	-100%	-	-
EU-27	**9 740**	**2 134**	**1 896**	**100%**	**-7 844**	**-81%**	**-238**	**-11%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.139 and Figure 3.140 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Solid fuel consumption in the EU decreased by 69% between 1990 and 2023. The CO_2 implied emission factor for solid fuels was 94.59 t/TJ in 2023.

Figure 3.139 1.A.4.c Agriculture/Forestry/Fisheries, solid fuels: Emission trend and share for CO_2

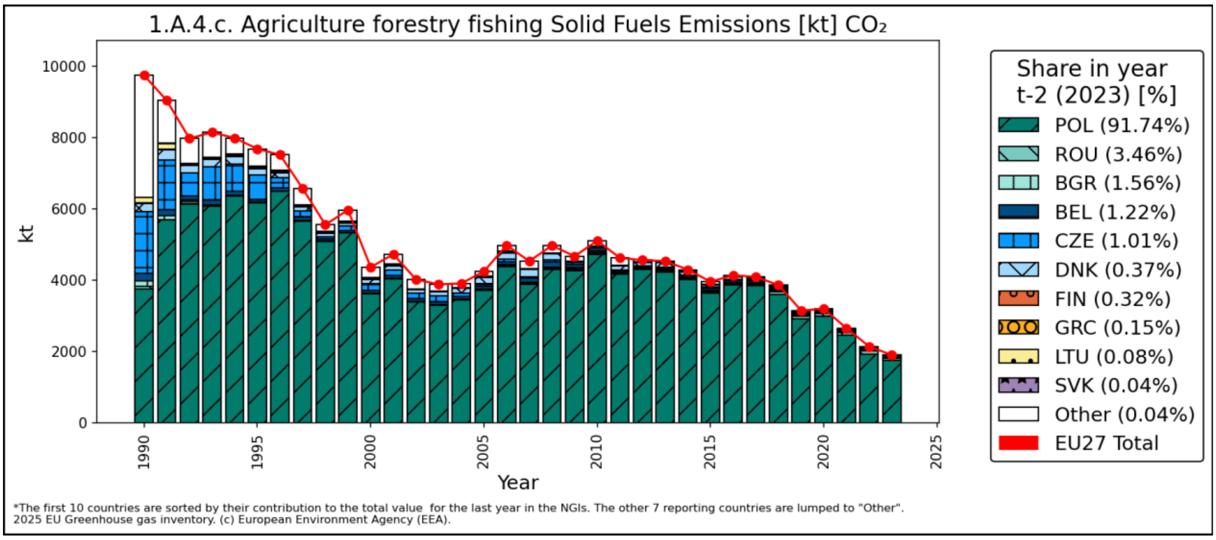
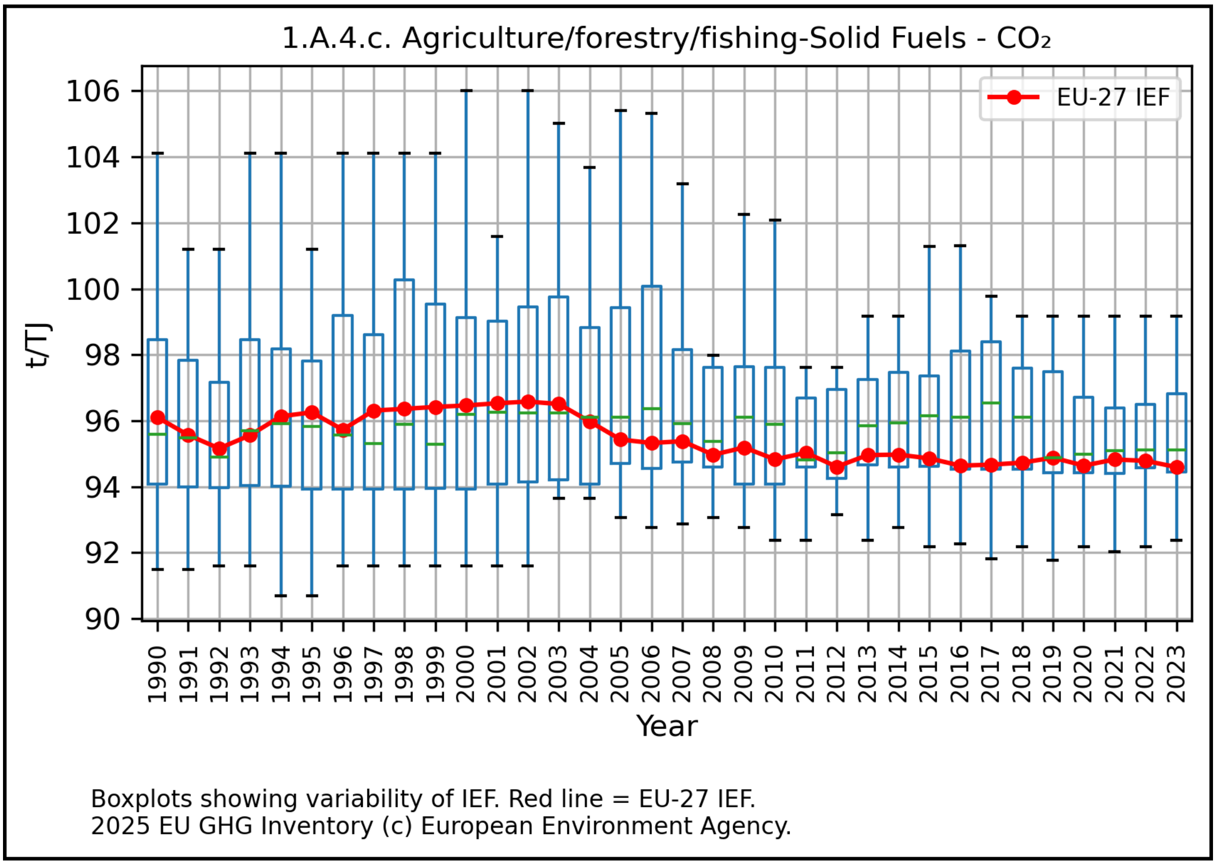


Figure 3.140 1.A.4.c Agriculture/Forestry/Fisheries, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



1.A.4.c Agriculture/Forestry/Fisheries –Gaseous Fuels (CO_2)

In 2023, CO_2 from gaseous fuels had a share of 15% within source category 1.A.4.c (compared to 13% in 1990). Between 1990 and 2023 CO_2 emissions decreased by 15% (Table 3.94). Between 2022 and 2023, EU emissions decreased by 7%.

Table 3.94 1.A.4.c Agriculture/Forestry/Fisheries, gaseous fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	20	47	26	0.2%	6	28%	-21	-45%
Belgium	67	1 138	1 308	12.5%	1 240	1838%	169	15%
Bulgaria	0	24	22	0.2%	22	11110%	-2	-6%
Croatia	48	60	52	0.5%	4	9%	-8	-14%
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	405	96	90	0.9%	-315	-78%	-6	-6%
Denmark	126	31	29	0.3%	-97	-77%	-2	-7%
Estonia	4	6	3	0.0%	0	-12%	-2	-43%
Finland	32	4	4	0.0%	-28	-89%	-1	-20%
France	320	386	347	3.3%	27	8%	-39	-10%
Germany	483	770	782	7.4%	299	62%	12	2%
Greece	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Hungary	433	221	198	1.9%	-235	-54%	-23	-10%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	52	935	901	8.6%	849	1632%	-34	-4%
Latvia	782	12	10	0.1%	-773	-99%	-2	-20%
Lithuania	162	47	47	0.4%	-115	-71%	0	0%
Luxembourg	NO	0	0	0.0%	0	∞	0	19%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	7 329	5 136	5 607	53.4%	-1 722	-23%	471	9%
Poland	25	85	94	0.9%	69	278%	9	10%
Portugal	NO	17	20	0.2%	20	∞	3	18%
Romania	1 917	182	139	1.3%	-1 778	-93%	-44	-24%
Slovakia	41	81	73	0.7%	33	80%	-8	-9%
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	6	523	744	7.1%	737	11968%	220	42%
Sweden	33	8	8	0.1%	-25	-76%	0	1%
EU-27	**12 287**	**9 809**	**10 502**	**100%**	**-1 784**	**-15%**	**694**	**7%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
The information on methodologies and emission factors is not available from the JSON on fuels level
Additional information is provided in Annex IX of the EU NID and in MS NIDs, which are also part of the EU submission.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.141 and Figure 3.142 show CO_2 emissions and implied emission factors for EU as well as the share of the Member States with the highest contributions. Gaseous fuel consumption in the EU decreased by 23% between 1990 and 2023. The CO_2 implied emission factor for gaseous fuels was 56.48 t/TJ in 2023.

Figure 3.141 1.A.4.c Agriculture/Forestry/Fisheries, gaseous fuels: Emission trend and share for CO_2

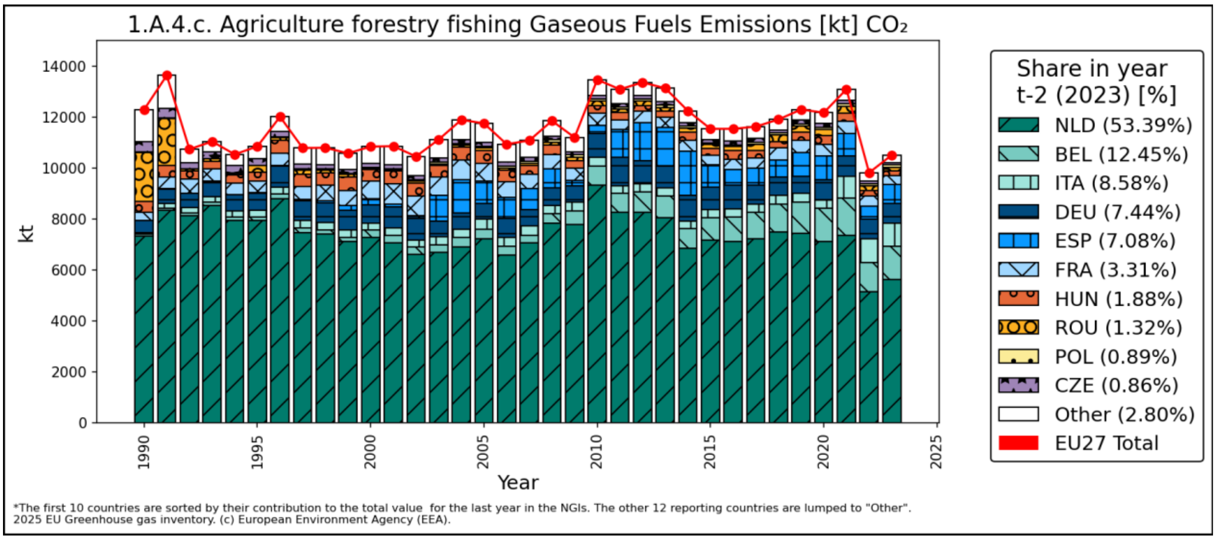
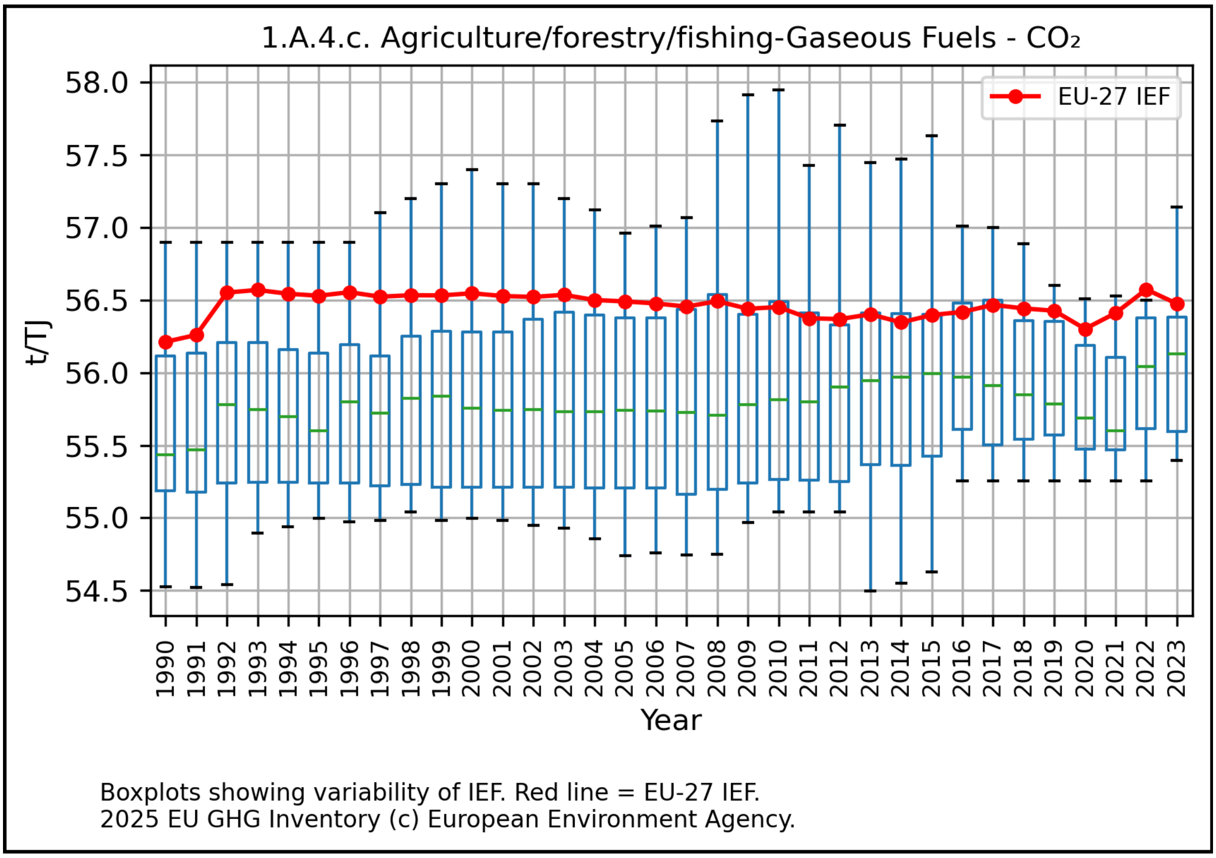


Figure 3.142 1.A.4.c Agriculture/Forestry/Fisheries, gaseous fuels: Implied Emission Factors for CO_2 (in t/TJ)



3.6.5 Other (CRT Source Category 1.A.5.)

Source category 1.A.5. Other includes emissions from stationary and mobile military fuel use including aircraft. In 2023, category 1.A.5 contributed to 7 325 kt CO_2 equivalents of which 99.2% is CO_2, 0.2% CH_4 and 0.6% N_2O. There are two key categories this year; 1.A.5.a Stationary: Solid Fuels (CO_2) and 1.A.5.b Mobile: Liquid Fuels (CO_2).

Table 3.95: Key source categories for level and trend analyses and share of MS emissions using higher tier methods for sector 1.A.5. (Table excerpt)

Source category gas	kt CO_2 eq.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
1.A.5.a Stationary: Solid Fuels (CO_2)	6065	4	T	0	0	97%
1.A.5.b Mobile: Liquid Fuels (CO_2)	8088	2722	0	L	0	83%

Table 3.96 provides an overview of Member States' source allocation to Source Category 1.A.5 Other as reported in CRT Table1.A(a)s4.

Table 3.96 1.A.5. Other: Member States' allocation of sources

Member State	Source allocation to 1.A.5 Other
Austria	Stationary: Emissions are 'Not occurring' Mobile: Military use
Belgium	Stationary: Emissions are 'Not occurring' Mobile: Military use
Bulgaria	Stationary: Emissions are 'Not occurring' Mobile: Military aviation
Croatia	Stationary: Emissions are 'Not occurring' Mobile: Emissions are 'Not occurring' or 'Included elsewhere' (emissions from military aviation component and military water-borne component are reported under 1.A.3.b)
Cyprus	Stationary: Emissions reported from Liquid Fuels Mobile: aviation component
Czechia	Stationary: Emissions are 'Not occurring' Mobile: Other mobile sources not included elsewhere, Agriculture and Forestry and Fishing (emissions from aviation besides the public air transport, it is consumption of aviation fuels in the army in the state institutions (aerial vehicles from Integrated rescue system), or private air transport)
Denmark	Stationary: Emissions are 'Not occurring' Mobile: Military use, Recreational crafts
Estonia	Emissions are 'Not occurring'
Finland	Stationary: Includes emissions from non-specified consumption of fuels, military use and statistical corrections of fuel consumption Mobile: Emissions are 'Not occurring' or 'Included elsewhere' (emissions and fuel consumptions of all fuels from category 1A5b is reported in 1A5a due to confidentiality)
France	Stationary: Other non-specified Mobile: Emissions are 'Not occurring' or 'Included elsewhere' (under 1.A.5.a)
Germany	Stationary: Military use Mobile: Military use
Greece	Stationary: Emissions are 'Not occurring' Mobile: Other (not specified elsewhere)
Hungary	Stationary: Military use – Emissions from Gaseous Fuels Mobile: Military use – Emissions from Liquid Fuels
Ireland	Stationary: Emissions are 'Included elsewhere' (under 1.A.4.a) Mobile: Emissions are 'Included elsewhere' (under 1.A.3)
Iceland	Stationary: Other (not specified elsewhere) Mobile: Emissions are 'Not occurring'
Italy	Stationary: Emissions are 'Not occurring' Mobile: Military use
Latvia	Stationary: Emissions are 'Not occurring' Mobile: Aviation gasoline, diesel oil and jet kerosene, used in aircrafts and ships
Lithuania	Stationary: Emissions are 'Not occurring' Mobile: Military use
Luxembourg	Stationary: Building and Plant Site Fuel Powered Machinery. Emissions are reported for 1990-2003 and 'Not occurring' from 2004 on. Mobile: Military Vehicles
Malta	Stationary: Emissions are 'Not occurring' Mobile: Military use

Member State	Source allocation to 1.A.5 Other
Netherlands	Stationary: Emissions are 'Not occurring' Mobile: military use
Poland	Stationary: Emissions are 'Included elsewhere' (without specification of allocation) Mobile: Emissions are 'Not occurring'
Portugal	Stationary: Emissions are 'Not occurring' Mobile: Military aviation
Romania	Stationary: Other sectors - Not elsewhere specified Mobile: Emissions are 'Included elsewhere' (under 1.A.5.a)
Slovakia	Stationary: Other, emissions from fuel combustion in stationary sources that are not specified elsewhere Mobile: Military use Jet Kerosene, Gasoline, Diesel Oil
Slovenia	Stationary: Emissions are 'Not occurring' Mobile: Military use
Spain	Stationary: Emissions are 'Not occurring' or 'Included elsewhere' (Included in 1.A.4.a.i - Military reference activity data are not separated from civil data, and their emissions are estimated together with the same methodology) Mobile: Military use
Sweden	Stationary: Emissions are 'Not occurring' Mobile: Emissions are 'Included elsewhere'

Figure 3.143 shows the total trend within source category 1.A.5 and the dominating emission sources: CO_2 emissions from 1.A.5.b Mobile and from 1.A.5.a Stationary.

Figure 3.143 1.A.5 Other: Total and CO_2 emission and activity trends

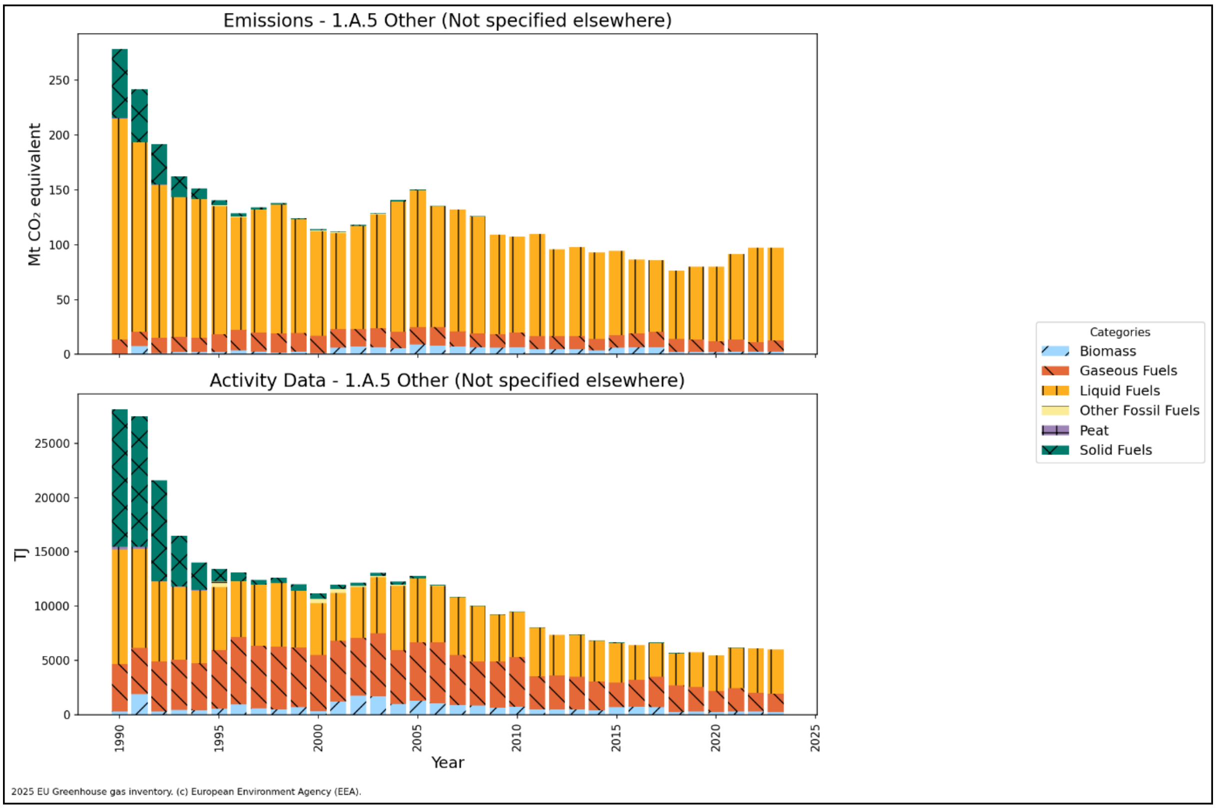


Table 3.97 shows total GHG and CO_2 emissions by Member State from 1.A.5. CO_2 emissions from 1.A.5 Other accounted for 0.3% of total EU GHG emissions in 1.A in 2023. Between 1990 and 2023, CO_2 emissions from this source decreased by 67% in the EU. Between 1990 and 2023, the largest reduction in absolute terms was reported by Germany, which was partly due to reduced military operations after the reunification. The German NID states that only military sources (incl. aircraft) are included in its inventory. Since 2014, the main contributor is France; contributing together 29% of CO_2 emissions in 2023. France includes in this category other non-specified sources from its national energy balance.

Table 3.97 1.A.5. Other: Member States' contributions to CO_2 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt	
	1990	2023	1990	2023
Austria	38	28	37	27
Belgium	173	98	172	97
Bulgaria	86	63	85	63
Croatia	IE,NO	IE,NO	IE,NO	IE,NO
Cyprus	11	23	11	23
Czechia	194	260	192	257
Denmark	171	266	167	263
Estonia	NO	NO	NO	NO
Finland	1 138	727	1 126	719
France	4 499	2 117	4 464	2 103
Germany	12 132	828	11 765	823
Greece	IE,NO	351	IE,NO	348
Hungary	388	62	385	62
Ireland	IE,NO	IE,NO	IE,NO	IE,NO
Italy	1 136	372	1 071	364
Latvia	NE,NO	24	NE,NO	24
Lithuania	0	46	0	46
Luxembourg	3	0	3	0
Malta	1	4	1	4
Netherlands	320	228	314	224
Poland	NO	NO	NO	NO
Portugal	97	49	96	49
Romania	1 230	1 187	1 222	1 183
Slovakia	479	66	476	65
Slovenia	32	4	32	4
Spain	301	522	298	517
Sweden	IE,NO	IE,NO	IE,NO	IE,NO
EU-27	**22 429**	**7 325**	**21 917**	**7 265**

Croatia reports that 'military aviation component and military water-borne component' are included in 1.A.3.b.
Ireland reports that emissions of military use stationary combustion are included in 1.A.4.a and that emissions from 1.A.5.b military are included in 1.A.3
Poland reports emissions from stationary combustion as 'IE' without specification of the allocation.
Abbreviations explained in the Chapter 'Units and abbreviations'.

3.6.5.1 Stationary (1.A.5.a)

In this chapter information about emission trends, Member States' contribution, activity data, and emission factors is provided for category 1.A.5.a by fuels. CO_2 emissions from 1.A.5.a Stationary accounted for 0.2% of total GHG emissions in 1.A in 2023. Figure 3.144 shows the emission trend within the categories 1.A.5.a, which is mainly dominated by CO_2 emissions from solid and liquid fuels for 1990 to 1993 and dominated by liquid fuels from 1994 on. The reduction in the early 1990s was driven by CO_2 from solid fuels. Total emissions decreased by 67% in the period 1990 - 2023, mainly due to decreases in emissions from solid fuels (-100%) and liquid fuels (-43%).

Figure 3.144 1.A.5.a Stationary: Total and CO_2 emission and activity trends

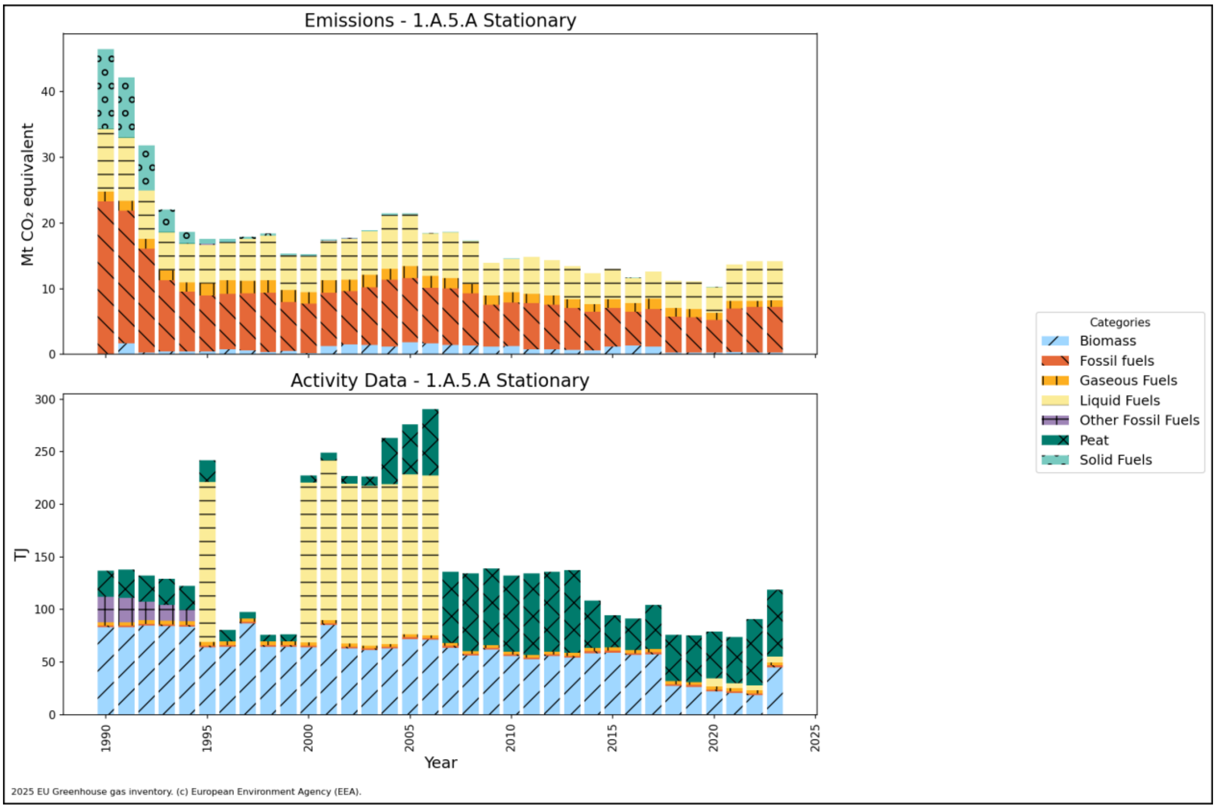


Table 3.98 1.A.5.a Stationary: Member States' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	NO	NO	NO	-	-	-	-	-	NA	NA
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	NO	NO	31	0.7%	31	∞	31	∞	T1	D
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	11	19	20	0.4%	9	83%	1	4%	NA,T1	D,NA
Czechia	NO	NO	-	-	-	-	-	-	-	-
Denmark	NO	NO	-	-	-	-	-	-	-	-
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 126	800	719	15.8%	-408	-36%	-81	-10%	NA,T2	CS,NA
France	4 464	1 966	2 103	46.3%	-2 362	-53%	136	7%	T1	CS,D,OTH,PS
Germany	6 227	409	393	8.6%	-5 834	-94%	-17	-4%	T2	CS
Greece	NO	NO	-	-	-	-	-	-	-	-
Hungary	370	38	34	0.7%	-337	-91%	-4	-11%	NA,T2	CS,NA
Ireland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Italy	NO	NO	NO	-	-	-	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	3	NO	NO	-	-3	-100%	-	-	NA	NA
Malta	NA	NA	NA	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	NO	NO	NO	-	-	-	-	-	NA	NA
Portugal	NO	NO	NO	-	-	-	-	-	IE	IE
Romania	1 222	1 169	1 183	26.0%	-38	-3%	14	1%	NA,T1,T2	CS,D,NA
Slovakia	406	53	61	1.3%	-345	-85%	8	14%	NA,T2	CS,NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Sweden	NO	NO	NO	-	-	-	-	-	NA	NA
EU-27	**13 829**	**4 455**	**4 543**	**100%**	**-9 286**	**-67%**	**88**	**2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.
Spain reports, that military reference activity data are not separated from civil data and that those emissions are estimated together in 1.A.4.a.i by applying the same methodology.
Ireland reports that emissions of military use stationary combustion are included in 1.A.4.a.
Poland reports the emissions under category 1.A.4.c.

1.A.5.a Stationary – Liquid Fuels (CO_2)

A new key category has been added this year; 1.A.5.b Mobile: Liquid Fuels (CO_2). In 2023, CO_2 from liquid fuels had a share of 87% within source category 1.A.5.a and the emissions were 3 972 kt CO_2. Between 1990 and 2023 CO_2 emissions decreased by 43%. (Table 3.99)

Table 3.99: 1.A.5.a Stationary, liquid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	NO	NO	NO	-	-	-	-	-	-	-
Belgium	-	-	-	-	-	-	-	-	-	-
Bulgaria	NO	NO	27	0.7%	27	∞	27	∞	-	-
Croatia	NO	NO	NO	-	-	-	-	-	-	-
Cyprus	11	19	20	0.5%	9	83%	1	4%	T1	D
Czechia	-	-	-	-	-	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-	-	-
Estonia	NO	NO	NO	-	-	-	-	-	-	-
Finland	1 036	716	642	16.2%	-394	-38%	-74	-10%	T2	CS
France	4 464	1 921	1 922	48.4%	-2 543	-57%	0	0%	-	-
Germany	1 166	146	177	4.4%	-989	-85%	31	21%	T2	CS
Greece	-	-	-	-	-	-	-	-	-	-
Hungary	259	3	NO	-	-259	-100%	-3	-100%	NA	NA
Ireland	IE	IE	IE	-	-	-	-	-	-	-
Italy	NO	NO	NO	-	-	-	-	-	-	-
Latvia	NO	NO	NO	-	-	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-	-	-
Luxembourg	3	NO	NO	-	-3	-100%	-	-	NA	NA
Malta	NA	NA	NA	-	-	-	-	-	-	-
Netherlands	NO	NO	NO	-	-	-	-	-	-	-
Poland	NO	NO	NO	-	-	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-	-	-
Romania	37	1 169	1 183	29.8%	1 146	3070%	14	1%	T1,T2	CS,D
Slovakia	35	1	1	0.0%	-34	-96%	0	4%	T2	CS
Slovenia	NO	NO	NO	-	-	-	-	-	-	-
Spain	IE	IE	IE	-	-	-	-	-	NA	NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**7 011**	**3 975**	**3 972**	**100%**	**-3 039**	**-43%**	**-4**	**0%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'

1.A.5.a Stationary – Solid Fuels (CO_2)

In 2023 CO_2 from solid fuels had a share of 0.1% within source category 1.A.5.a (compared to 44% in 1990). Between 1990 and 2023, CO_2 emissions decreased by nearly 100% (Table 3.100). The main reason for the strong decline of emissions in the early 1990s was the closure of military barracks after the German reunification and the phase out of coal use for combustion in buildings.

Ireland reports that emissions of military use stationary combustion are included in 1.A.4.a. Spain reports, that military reference activity data are not separated from civil data and that those emissions are estimated together in 1.A.4.a.i by applying the same methodology.

Table 3.100 1.A.5.a Stationary, solid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	NO	NO	NO	-	-	-	-	-	-	-
Belgium	-	-	-	-	-	-	-	-	-	-
Bulgaria	NO	NO	0	3.6%	0	∞	0	∞	-	-
Croatia	NO	NO	NO	-	-	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	-	-	-	-	-	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-	-	-
Estonia	NO	NO	NO	-	-	-	-	-	-	-
Finland	1	NO	NO	-	-1	-100%	-	-	NA	NA
France	NO	NO	NO	-	-	-	-	-	-	-
Germany	4 553	3	3	83.5%	-4 550	-100%	0	-8%	T2	CS
Greece	-	-	-	-	-	-	-	-	-	-
Hungary	111	NO	NO	-	-111	-100%	-	-	NA	NA
Ireland	NO	NO	NO	-	-	-	-	-	-	-
Italy	NO	NO	NO	-	-	-	-	-	-	-
Latvia	NO	NO	NO	-	-	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-	-	-
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NA	NA	NA	-	-	-	-	-	-	-
Netherlands	NO	NO	NO	-	-	-	-	-	-	-
Poland	NO	NO	NO	-	-	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-	-	-
Romania	1 184	NO	NO	-	-1 184	-100%	-	-	NA	NA
Slovakia	216	0	0	13.0%	-216	-100%	0	13%	T2	CS
Slovenia	NO	NO	NO	-	-	-	-	-	-	-
Spain	IE	IE	IE	-	-	-	-	-	NA	NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**6 065**	**4**	**4**	**100%**	**-6 062**	**-100%**	**0**	**-2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.145 shows CO_2 emissions for EU and some of the Member States.

Figure 3.145 1.A.5.a Stationary, solid fuels: Emission trend and share for CO_2

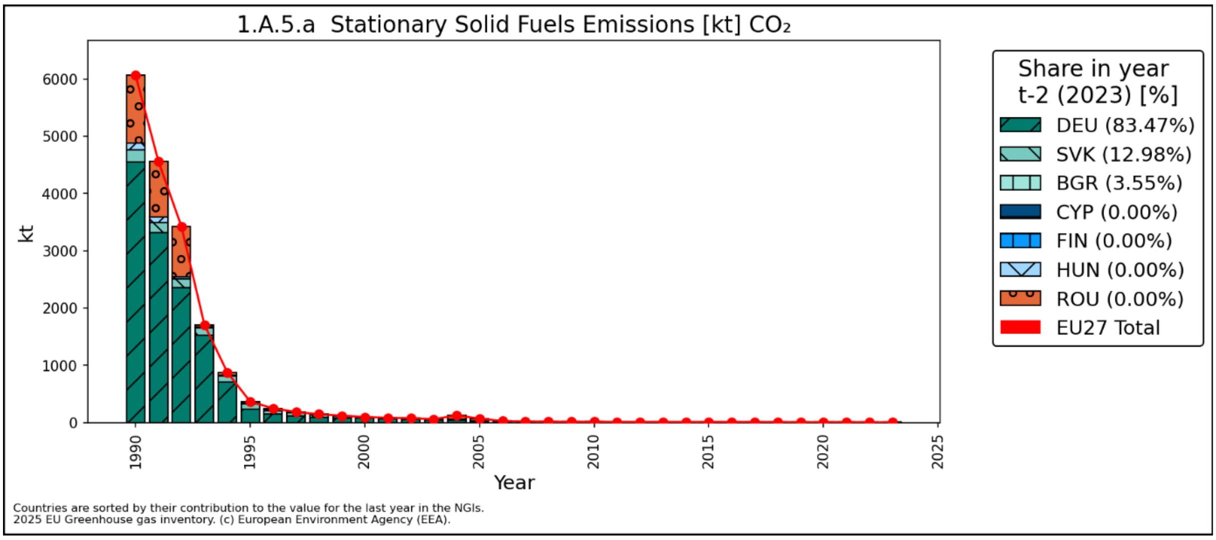
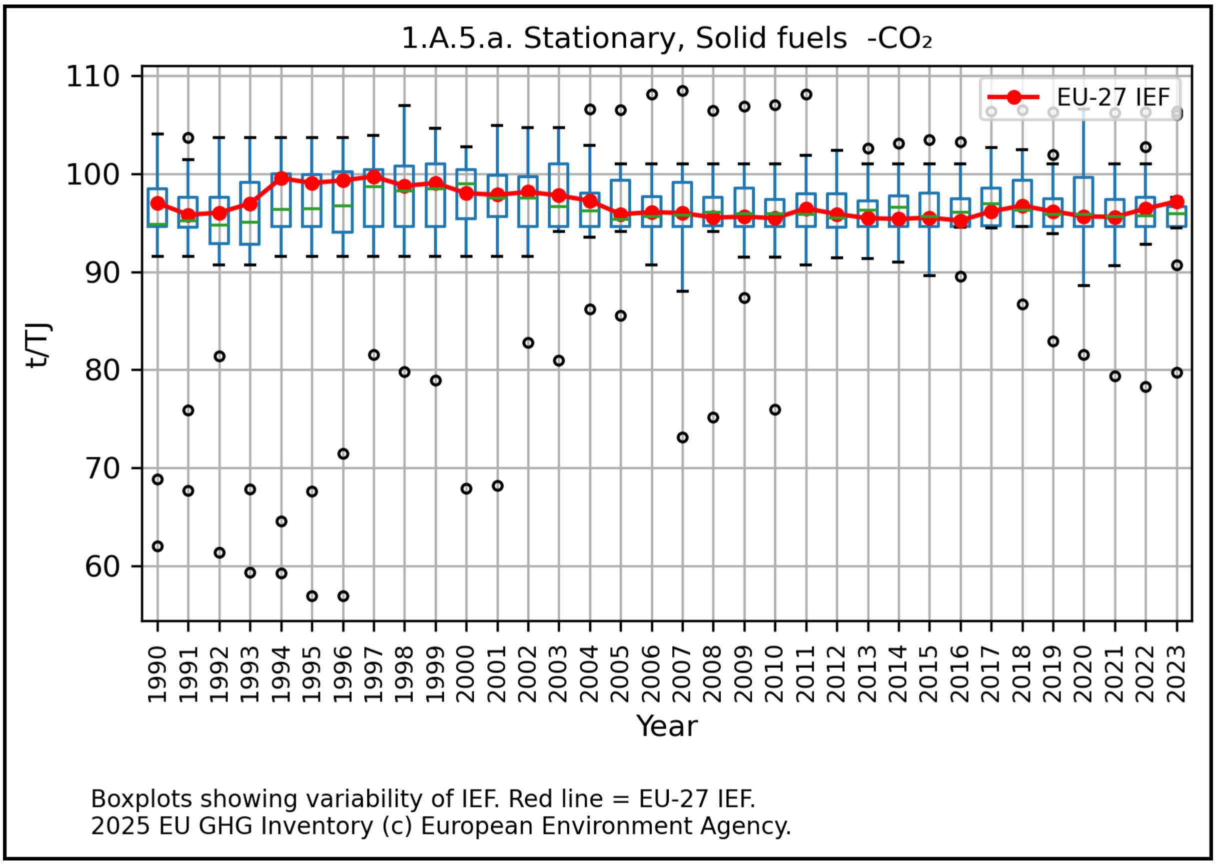


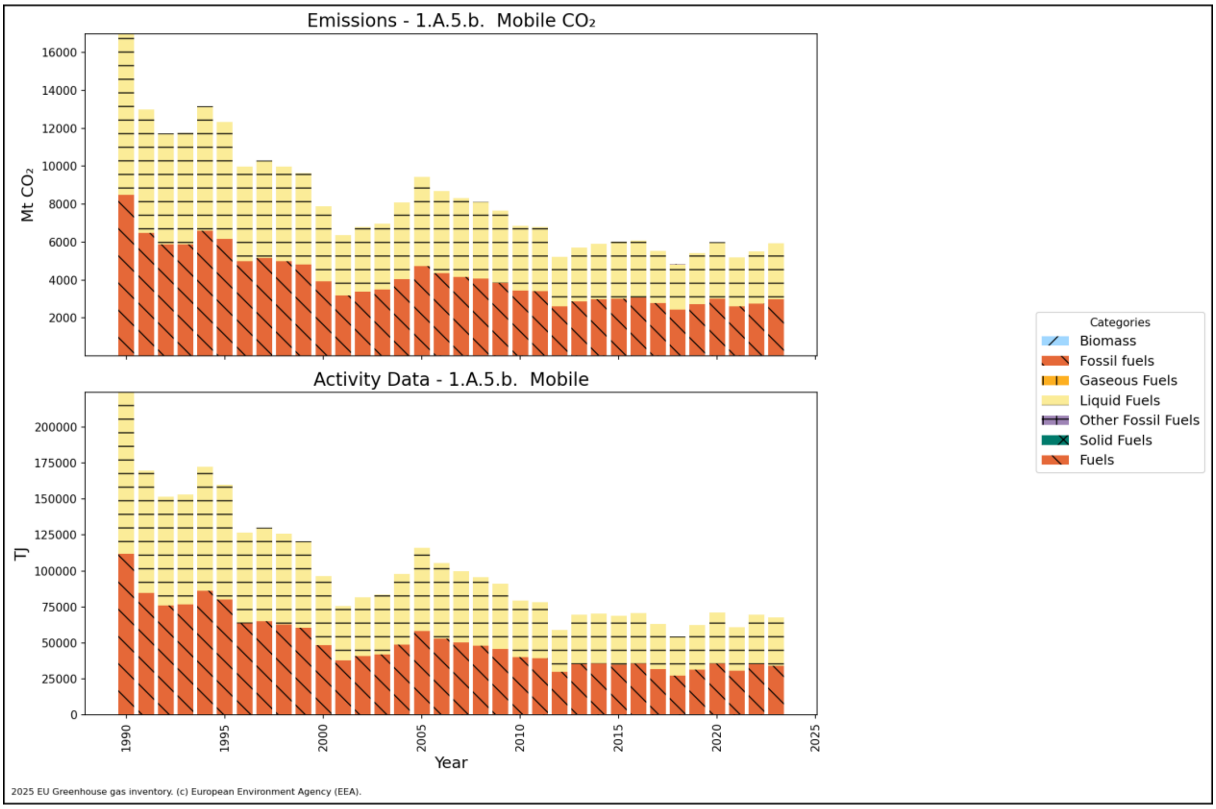
Figure 3.146 1.A.5.a Stationary, solid fuels: Implied Emission Factors for CO_2 (in t/TJ)



3.6.5.2 Mobile (1.A.5.b)

In this chapter information about emission trends, Member States' contribution and activity data is provided for category 1.A.5.b by fuels. CO_2 emissions from 1.A.5.b Mobile accounted for 0.1% of total EU GHG emissions in 1.A in 2023. Figure 3.147 shows the emission trend within the category 1.A.5.b, which is dominated by CO_2 emissions from liquid fuels. Total CO_2 emissions decreased by 67% and were 2 673 kt CO_2 in the year 2023.

Figure 3.147 1.A.5.b Mobile: Activity Data and CO_2 emission trends



The EU emissions increased by 7% between 2022 and 2023. “Included elsewhere” often indicates, that the country reports these emissions under 1.A.3 Transport or 1.A.5.a.

Table 3.101 1.A.5.b Mobile: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	37	28	27	1.0%	-10	-27%	0	-2%	NA,T2	CS,NA
Belgium	172	97	97	3.6%	-75	-43%	0	0%	NA,T1	D,NA
Bulgaria	85	39	31	1.2%	-54	-63%	-8	-20%	T1	D
Croatia	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Cyprus	NA,NO	5	3	0.1%	3	∞	-2	-38%	NA,T1	D,NA
Czechia	192	264	257	9.6%	65	34%	-7	-3%	NA,T2	CS,NA
Denmark	167	186	263	9.8%	96	57%	77	42%	NA,T2	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
France	IE,NO	IE,NO	IE,NO	-	-	-	-	-	T1	CS,D,OTH,PS
Germany	5 538	448	430	16.1%	-5 108	-92%	-18	-4%	CS,D,M	CS
Greece	IE,NO	299	348	13.0%	348	∞	49	16%	NA,T1	D,NA
Hungary	14	35	28	1.1%	14	96%	-6	-18%	NA,T2	CS,NA
Ireland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Italy	1 071	511	364	13.6%	-707	-66%	-147	-29%	T2	CS
Latvia	NE,NO	24	24	0.9%	24	∞	0	0%	NA,T1	D,NA
Lithuania	0	30	46	1.7%	45	12578%	16	54%	NA,T2	CS,NA
Luxembourg	0	0	0	0.0%	0	-14%	0	0%	NA,T1,T2	CS,D,NA
Malta	1	3	4	0.1%	3	363%	0	9%	NA,T1	D,NA
Netherlands	314	212	224	8.4%	-90	-29%	13	6%	NA,T2	CS,NA
Poland	NO	NO	NO	-	-	-	-	-	NA	NA
Portugal	96	89	-	-	-96	-100%	-89	-100%	-	-
Romania	IE	IE	IE	-	-	-	-	-	NA	NA
Slovakia	70	8	4	0.2%	-66	-94%	-4	-50%	NA,T1	D,NA
Slovenia	32	5	4	0.2%	-27	-86%	0	-5%	NA,T1	D,NA
Spain	298	225	517	19.3%	219	74%	292	130%	CR,NA,T1,T2	CS,D,NA
Sweden	IE,NO	IE,NO	IE,NO	-	-	-	-	-	T2	CS
EU-27	**8 088**	**2 509**	**2 673**	**100%**	**-5 414**	**-67%**	**165**	**7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Croatia reports emissions from military aviation and navy in category 1.A.3.b.
Finland reports emissions from military activities as 'IE' for reasons of confidentiality.
France and Romania report emissions in category 1.A.5.a
Ireland reports emission from military activities in category 1.A.3.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1.A.5.b Mobile – Liquid Fuels (CO_2)

In 2023, CO_2 from liquid fuels had a share of 99.9% within source category 1.A.5.b throughout the whole period. Between 1990 and 2023 CO_2 decreased by 57% (Table 3.102 1.A.5.b Mobile, liquid fuels: Member States' contributions to CO2 emissions).

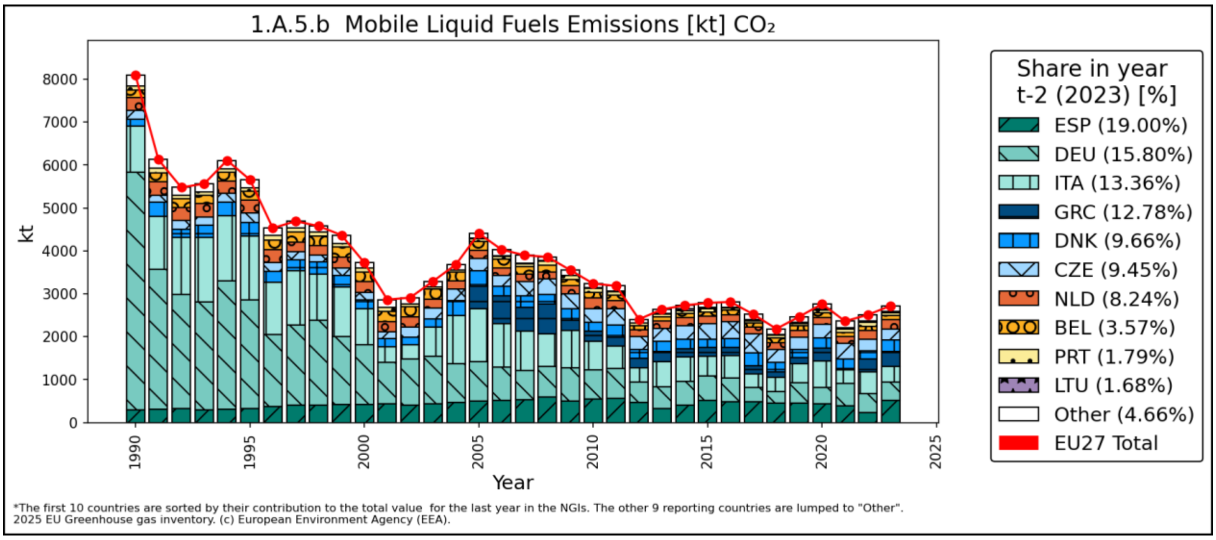
Table 3.102 1.A.5.b Mobile, liquid fuels: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	37	28	27	1.3%	-10	-27%	0	-2%	T2	CS
Belgium	172	97	97	4.5%	-75	-43%	0	0%	T1	D
Bulgaria	85	39	31	1.4%	-54	-63%	-8	-20%	-	-
Croatia	IE	IE	IE	-	-	-	-	-	NA	NA
Cyprus	NO	5	3	0.1%	3	∞	-2	-38%	T1	D
Czechia	NO	50	47	2.2%	47	∞	-3	-6%	T2	CS
Denmark	48	92	93	4.3%	45	93%	0	0%	T2	-
Estonia	NO	NO	NO	-	-	-	-	-	-	-
Finland	IE	IE	IE	-	-	-	-	-	NA	NA
France	IE	IE	IE	-	-	-	-	-	-	-
Germany	2 813	260	247	11.4%	-2 566	-91%	-13	-5%	CS,D,M	CS
Greece	IE	299	348	16.1%	348	∞	49	16%	T1	D
Hungary	14	35	28	1.3%	14	96%	-6	-18%	T2	CS
Ireland	IE	IE	IE	-	-	-	-	-	-	-
Italy	1 071	511	364	16.9%	-707	-66%	-147	-29%	-	-
Latvia	NE	24	24	1.1%	24	∞	0	0%	T1	D
Lithuania	0	30	46	2.1%	45	12578%	16	54%	T2	CS
Luxembourg	0	0	0	0.0%	0	-14%	0	0%	T2	CS
Malta	1	3	4	0.2%	3	363%	0	9%	T1	D
Netherlands	314	212	224	10.4%	-90	-29%	13	6%	T2	CS
Poland	NO	NO	NO	-	-	-	-	-	-	-
Portugal	96	89	49	2.3%	-47	-49%	-41	-45%	-	-
Romania	IE	IE	IE	-	-	-	-	-	NA	NA
Slovakia	70	8	4	0.2%	-66	-94%	-4	-50%	T1	D
Slovenia	32	5	4	0.2%	-27	-86%	0	-5%	T1	D
Spain	298	225	517	24.0%	219	74%	292	130%	CR,T1	CS,D
Sweden	IE	IE	IE	-	-	-	-	-	T2	CS
EU-27	**5 052**	**2 013**	**2 158**	**100%**	**-2 894**	**-57%**	**145**	**7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Information on methods and emission factors are identical with those described in Table ***3.101*** *as emissions from this source only occur in liquid fuels*
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.148 shows CO_2 emissions for EU and the Member States.

Figure 3.148 1.A.5.b Mobile, liquid fuels: Emission trend and share for CO_2

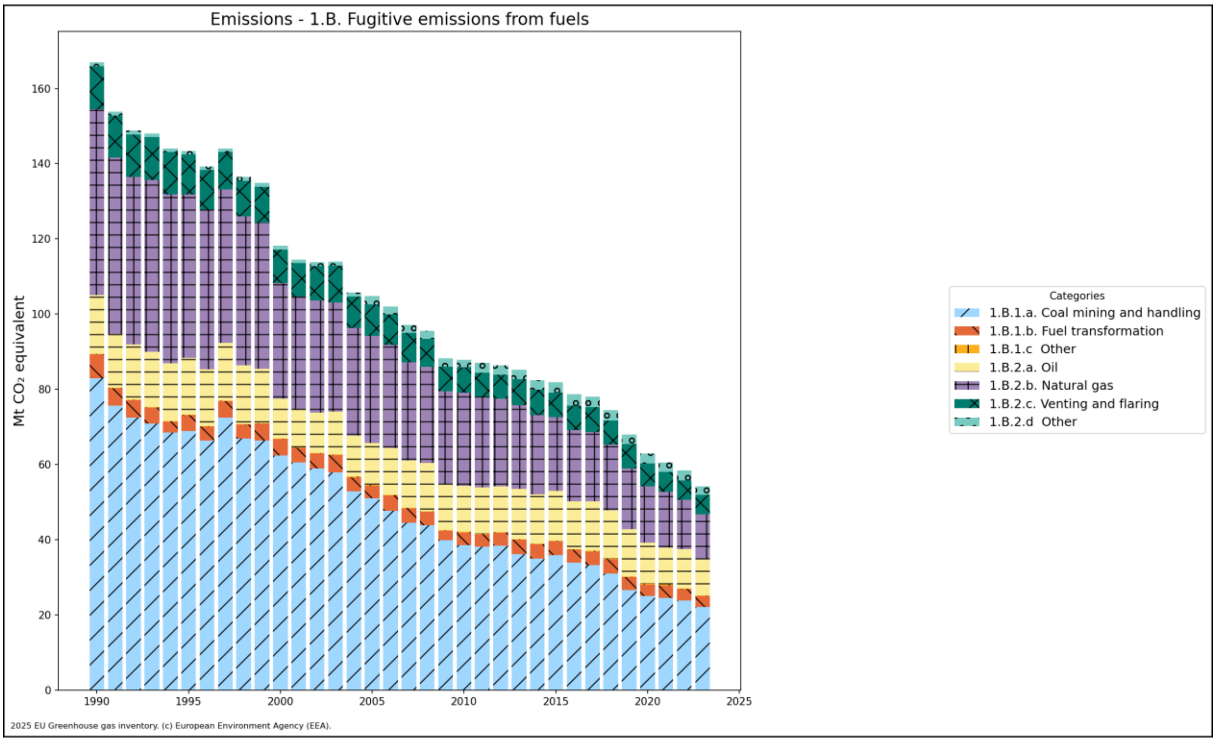


3.6.6 Fugitive emissions from fuels (CRT Source Category 1.B)

This chapter describes gaseous or volatile emissions, which occur during extraction, handling and consumption of fossil fuels. In the 2006 IPCC Guidelines fugitive emissions are defined as intentional or unintentional releases of gases from anthropogenic activities that in particular may arise from the production, processing, transmission, storage and use of fuels. Emissions from combustion are only included where it does not support productive activity (e.g., flaring of natural gases at oil and gas production facilities). Evaporative emissions from vehicles are included under Road Transport as Subsection 1A3b v (2006 IPCC Guidelines).

In 2023, in terms of CO_2 equivalents, about 69 % of emissions from source category 1.B were fugitive CH_4 emissions while 31 % were fugitive CO_2 emissions. Together, they represent 1.9 % of total GHG emissions in the EU. Fugitive GHG emissions have been steadily declining (Figure 3.149). Between 1990 and 2023, the total fugitive GHG emissions decreased by 68 %. This was mainly due to the decrease in underground mining activities: CH_4 emissions from underground mining activities have decreased by 75 % since 1990 (Figure 3.152) and decreases in CH_4 emissions from category 1B1ai1 underground mines are responsible for 51 % of the total decrease of fugitive emissions. Between 1990 and 2023, GHG emissions from 1.B.1 Solid Fuels decreased by 72 % (Figure 3.150), while emissions from 1.B.2 Oil and Natural Gas decreased by 62 %.

Figure 3.149 1.B Fugitive Emission from Fuel: GHG Emissions trend



Fugitive emissions include four key sources:

*Table 3.103: Key source categories for level and trend analyses and share of countries emissions using higher tier methods in sector 1.B (table **excerpt)***

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
1.B.1.a. Coal mining and handling: no classification (CH_4)	82199	21939	T	L	L	75 %
1.B.2.a. Oil: no classification (CH_4)	6993	728	T	0	0	39%
1.B.2.a. Oil: no classification (CO_2)	8633	8941	T	L	L	86 %
1.B.2.b. Natural gas: no classification (CH_4)	47005	11275	T	L	L	69 %

The two largest key sources (CH_4 emissions from 1.B.1.a Coal Mining and Handling and 1.B.2.b Natural Gas) account together for 61 % of total fugitive GHG emissions.

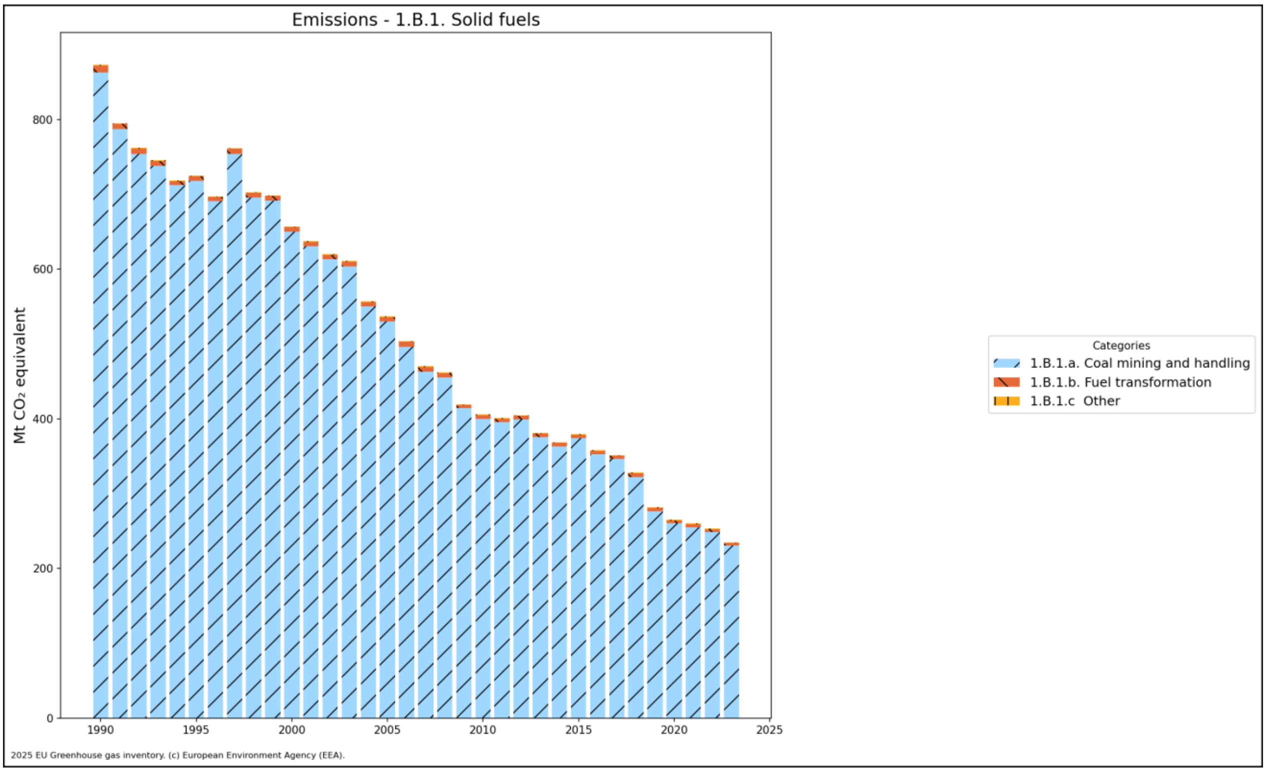
3.6.6.1 Fugitive emissions from Solid Fuels (1.B.1)

In the 2006 IPCC Guidelines fugitive emissions from solid fuels are defined as the intentional or unintentional release of greenhouse gases that may occur during the extraction, processing and delivery of fossil fuels to the point of final use. Combustion emissions from colliery methane recovered and used are excluded here and reported under Fuel Combustion Emissions. Coal mining data reported to the IEA include also peat extraction, which is not included in the CRT. Five countries (Denmark, Estonia, Finland, Latvia and Lithuania) have peat extraction but no coal mining.

In 2023 fugitive emissions from solid fuels accounted for 0.9 % of the total GHG emissions in the EU and 46 % of total fugitive emissions:

- 87 % of fugitive emissions from solid fuels were CH_4 emissions from coal mining. The emissions arise due to the natural production of methane when coal is formed. Methane is partly stored within the coal seam and escapes when mined. Most CH_4 emissions resulted from underground mines; surface mines were a smaller source,
- 11 % of fugitive emissions from solid fuels were emissions due to solid fuel transformation,
- Since 1990 fugitive CH_4 emissions from 1.B.1 Solid fuels have been steadily decreasing, caused by the reduction of coal mining activities.

Figure 3.150   1.B.1 Fugitive Emissions from Solid Fuels: Trend



In 2023 three countries, Poland, Czechia and Romania represented 90 % of total fugitive GHG emissions from solid fuels (Table 3.104).

Table 3.104 1.B.1 Fugitive Emissions from Solid Fuels: Countries Contribution

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
Austria	373	NA,IE,NO	IE,NA,NO	IE,NA,NO	373	IE,NA,NO
Belgium	485	37	0	IE,NO	484	37
Bulgaria	2 244	695	64	17	2 180	678
Croatia	67	NO	NO	NO	67	NO
Cyprus	NO	NO	NO	NO	NO	NO
Czechia	9 862	635	456	34	9 406	601
Denmark	NO	NO	NO	NO	NO	NO
Estonia	NO	NO	NO	NO	NO	NO
Finland	NO	NO	NO	NO	NO	NO
France	5 387	12	NA,NO	NA,NO	5 387	12
Germany	30 412	793	1 833	692	28 579	101
Greece	1 266	263	NO	NO	1 266	263
Hungary	1 188	33	7	3	1 181	31
Ireland	62	19	NO	NO	62	19
Italy	148	29	0	NA,NO	148	29
Latvia	NO	NO	NO	NO	NO	NO
Lithuania	NO	NO	NO	NO	NO	NO
Luxembourg	NO	NO	NO	NO	NO	NO
Malta	NO	NO	NO	NO	NO	NO
Netherlands	123	71	110	66	12	5
Poland	27 896	16 273	4 188	1 954	23 707	14 320
Portugal	160	17	3	NO	157	17
Romania	6 571	5 620	NA,NO	NA,NO	6 571	5 620
Slovakia	815	182	20	48	795	134
Slovenia	505	295	101	99	404	196
Spain	1 832	111	18	88	1 815	23
Sweden	10	10	5	6	5	4
EU-27	**89 406**	**25 095**	**6 806**	**3 006**	**82 600**	**22 089**

Abbreviations explained in the Chapter 'Units and abbreviations'
Austria includes emissions from 1.B.1.b – production of coke oven coke – in 1.A.2.a Iron and Steel
Hungary reports fugitive methane emissions released during coal mining and handling under sector 1.A.2. Fugitive emissions from solid fuel transformation are included in sector 1.A.1.c.

Nearly all fugitive CH_4 emissions from solid fuels originate from coal mining and handling (1B1a). Between 1990 and 2023 these emissions decreased by 73 % (Table 3.105).

CH_4 recovery from coal mining

Romania is the only country that reports CH_4 recovery in category 1.B.1.a.i.1 (Mining activities) in the EU in 2023. The recovered CH_4 from Lupeni and Vulcan mines is included in '1.B.1.a Coal Mining and Handling, 1.B.1.a.i Underground Mines, 1.B.1.a.i.1 Mining Activities, Recovery / Flaring CH_4' category. [ROU NID, 2025]

CH_4 from Coal Mining (1.B.1.a)

Fugitive emissions from coal mining correspond to the total emissions from:

- underground mining (emissions from underground mines, brought to the surface by ventilation systems),
- surface mining (emissions primarily from the exposed coal surfaces and coal rubble, but also emissions associated with the release of pressure on the coal),
- post-mining (emissions from coal after extraction from the ground, which occur during preparation, transportation, storage, or final crushing prior to combustion),
- abandoned underground mines
- Flaring of drained methane or conversion of methane to CO_2
- Other.

CH_4 emissions from 1.B.1.a coal-mining accounted for 0.8 % of total GHG emissions in 2023 and for 40 % of all fugitive emissions in the EU. CH_4 emissions from this source decreased by 73 % in the EU between 1990 and 2023 and also decreased by -7 % between 2022 and 2023(Table 3.105).

Table **3.105** shows that 75 % of EU emissions are calculated using higher tier methods. In cases where countries report a mix of Tier 1 and higher Tier methods, only emissions from subcategories of sector 1.B.1.a were taken into account, where the countries actually apply a higher tier method, according to the IPCC 2006 Guidelines.

Table 3.105 1.B.1.a Coal Mining: Countries contribution to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	373	NA,NO	NA,NO	-	-373	-100%	-	-	NA	NA
Belgium	443	38	37	0.2%	-406	-92%	0	-1%	NA	D,NA
Bulgaria	2 163	1 044	678	3.1%	-1 485	-69%	-366	-35%	NA,T1,T2	CS,D,NA
Croatia	67	NO	NO	-	-67	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	9 405	680	596	2.7%	-8 809	-94%	-84	-12%	NA,T1,T2	CS,D,NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	5 354	1	1	0.0%	-5 353	-100%	0	0%	NA,T2,T3	CS,NA
Germany	28 554	103	90	0.4%	-28 464	-100%	-13	-13%	NA,T2,T3	CS,NA
Greece	1 266	348	263	1.2%	-1 003	-79%	-85	-24%	NA,T1	D,NA
Hungary	1 181	31	30	0.1%	-1 151	-97%	-1	-2%	NA,T1,T2	CS,D,NA
Ireland	62	19	19	0.1%	-43	-69%	0	-1%	NA,T1	D,NA
Italy	59	7	7	0.0%	-52	-88%	0	-6%	NA,T2	CS,NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	23 581	15 167	14 234	64.9%	-9 346	-40%	-933	-6%	NA,T1,T2	D,NA
Portugal	157	17	17	0.1%	-140	-89%	0	-1%	NA,NO,T1	D,NA,NO
Romania	6 524	5 833	5 620	25.6%	-905	-14%	-213	-4%	NA,T1,T2	D,NA
Slovakia	792	158	127	0.6%	-664	-84%	-30	-19%	NA,T1,T2	CS,D,NA
Slovenia	404	181	196	0.9%	-208	-51%	16	9%	NA,T2,T3	CS,D,NA,PS
Spain	1 815	25	23	0.1%	-1 791	-99%	-1	-5%	CS,NA,T2	CS,NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**82 199**	**23 651**	**21 939**	**100%**	**-60 260**	**-73%**	**-1 711**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 from Underground mines (1.B.1.a.i)

In 2023, 90% of fugitive CH_4 emissions from coal mines were due to underground mines. Within the EU coal mining in underground mines decreased substantially between 1990 and 2023 (-75 %) (Table **3.106** and Figure 3.152).

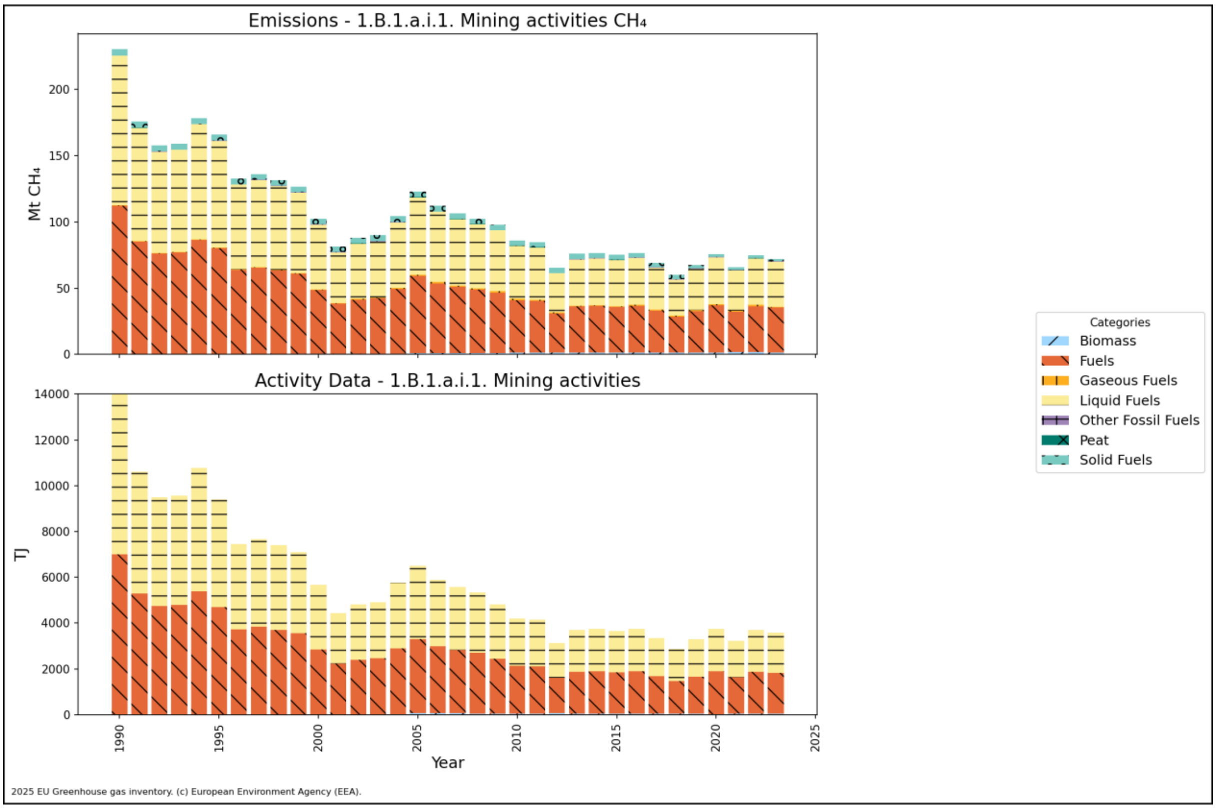
For detailed information on countries methodologies please see Annex III.

Table 3.106 1.B.1.a.1 Coal Mining – underground mining: Countries contribution to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	335	NA,NO	NA,NO	-	-335	-100%	-	-	NA	NA
Belgium	443	38	37	0.2%	-406	-92%	0	-1%	NA	D,NA
Bulgaria	1 484	178	166	0.8%	-1 318	-89%	-11	-6%	NA,T2	CS,NA
Croatia	67	NO	NO	-	-67	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	9 140	566	498	2.5%	-8 642	-95%	-68	-12%	NA,T1,T2	CS,D,NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	5 302	1	1	0.0%	-5 300	-100%	0	0%	NA,T2,T3	CS,NA
Germany	28 444	62	58	0.3%	-28 386	-100%	-4	-6%	NA,T3	CS,NA
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	1 181	31	30	0.2%	-1 151	-97%	0	-1%	NA,T1	D,NA
Ireland	62	19	19	0.1%	-43	-69%	0	-1%	NA,T1	D,NA
Italy	22	7	7	0.0%	-15	-69%	0	-6%	NA,T2	CS,NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	21 933	13 835	13 257	67.3%	-8 676	-40%	-578	-4%	NA,T1,T2	D,NA
Portugal	157	17	17	0.1%	-140	-89%	0	-1%	NA,NO,T1	D,NA,NO
Romania	5 915	5 394	5 263	26.7%	-652	-11%	-130	-2%	NA,T1,T2	D,NA
Slovakia	792	158	127	0.6%	-664	-84%	-30	-19%	NA,T1,T2	CS,D,NA
Slovenia	404	181	196	1.0%	-208	-51%	16	9%	NA,T2,T3	CS,D,NA,PS
Spain	1 814	25	23	0.1%	-1 790	-99%	-1	-5%	CS,NA,T2	CS,NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**77 495**	**20 510**	**19 701**	**100%**	**-57 794**	**-75%**	**-810**	**-4%**	**-**	**-**

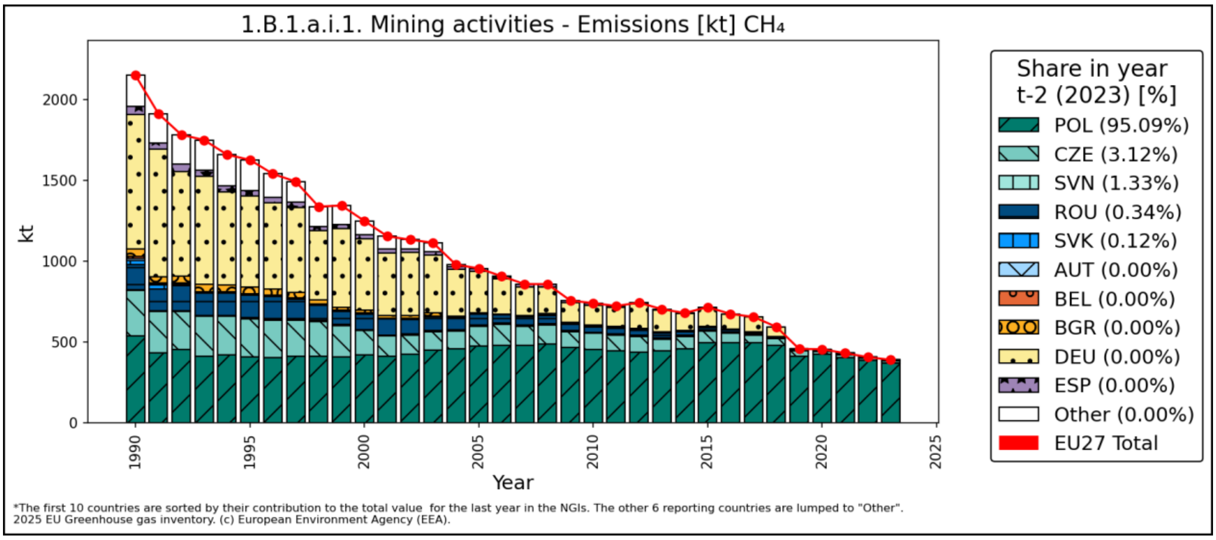
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.151 1.B.1.a.i.1 Mining activities - Underground Mines: Emission trend and activity data for EU CH_4



CH_4 emissions from 1.B.1.a.i.1 – underground mines, mining activities are responsible for 55% of total GHG emissions from 1.B.1.a.i. The decrease of emissions is mainly caused by the closure of underground mining in Germany.

Figure 3.152 1.B.1.a.i.1 Mining activities - Underground Mines: Emission trend and share for EU-28 and the emitting countries of CH_4



CH_4 from Surface mines (1.B.1.a.ii)

In 2023, only 10% of CH_4 emissions from coal mining originate from surface mining. Overall, CH_4 emissions from the coal production of surface mines decreased by 52 % between 1990 and 2023 (Table **3.107** and Figure 3.153).

For detailed information on countries methodologies please see Table **3.107** and Annex III.

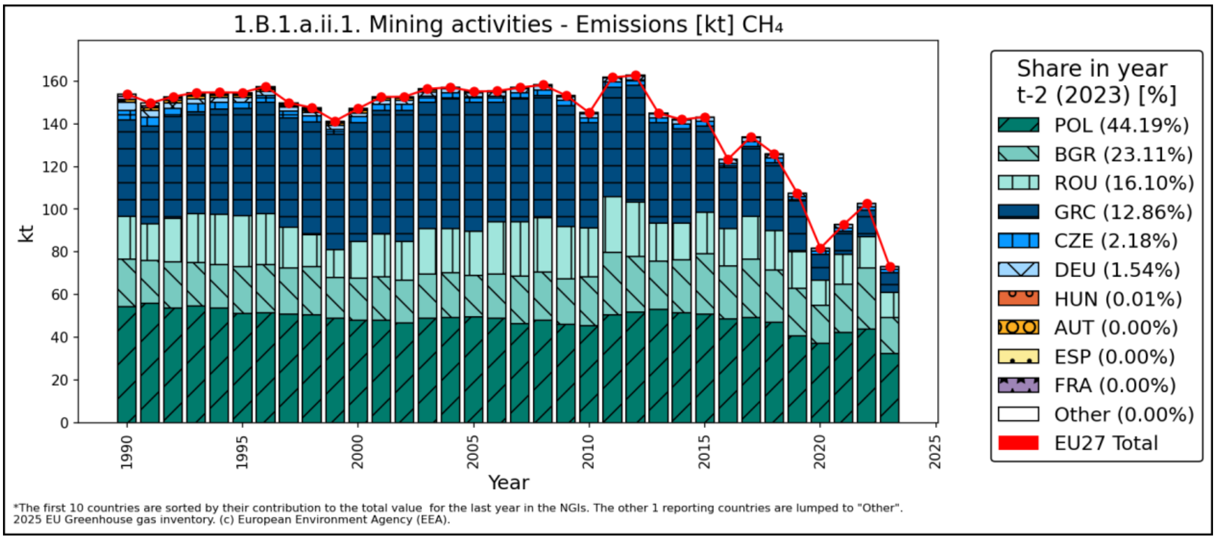
Table 3.107 1.B.1.a.ii Coal Mining – surface mining: Countries contribution to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	38	NO	NO	-	-38	-100%	-	-	NA	NA
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	679	866	511	22.8%	-167	-25%	-355	-41%	NA,T1,T2	D,NA
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	265	115	98	4.4%	-167	-63%	-16	-14%	NA,T1,T2	D,NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	53	NO	NO	-	-53	-100%	-	-	T2,T3	CS
Germany	110	40	31	1.4%	-78	-71%	-9	-22%	NA,T2	CS,NA
Greece	1 266	348	263	11.7%	-1 003	-79%	-85	-24%	NA,T1	D,NA
Hungary	NO	0	0	0.0%	0	∞	0	-40%	NA,T2	CS,NA
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	37	NO	NO	-	-37	-100%	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	1 648	1 332	978	43.7%	-670	-41%	-354	-27%	NA,T1	D,NA
Portugal	NO	NO	NO	-	-	-	-	-	NO	NO
Romania	609	439	356	15.9%	-252	-41%	-83	-19%	NA,T1	D,NA
Slovakia	NO	NO	NO	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	1	NO	NO	-	-1	-100%	-	-	NA	NA
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**4 705**	**3 140**	**2 239**	**100%**	**-2 466**	**-52%**	**-902**	**-29%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.153 shows the emission trend and share of emitting countries of CH_4 emissions of subcategory 1.B.1.a.ii.1 – mining activities from surface mines, which are responsible for 91 % of total GHG emissions from 1.B.1.a.ii.

Figure 3.153 1.B.1.a.ii.1 Mining activities - Surface Mines: Emission trend and share for the emitting countries of CH_4



Emissions from Other (1.B.1.c)

Fugitive emissions from category 1.B.1.c (other) account for 0.3% of total fugitive emissions and 0.6% of emissions from solid fuels (1.B.1). Only 3 countries report fugitive emissions from this source (see Table 3.108)

Table 3.108 Description of subcategories in sector 1.B.1c for CO_2- and CH_4-emissions for reporting countries

Member state	Emission	Subcategory
Poland	CO_2, CH_4	Emissions from Coke Oven Gas Subsystem
Slovenia	CO_2	SO_2 scrubbing
Sweden	CO_2, CH_4, N_2O	Flaring of gas

3.6.6.2 Fugitive emissions from oil and natural gas (1.B.2)

Fugitive emissions from oil and natural gas correspond to the total fugitive emissions from oil and natural gas activities. Fugitive emissions may arise from equipment leaks, evaporation losses, venting, flaring and accidental releases (2006 IPCC Guidelines).

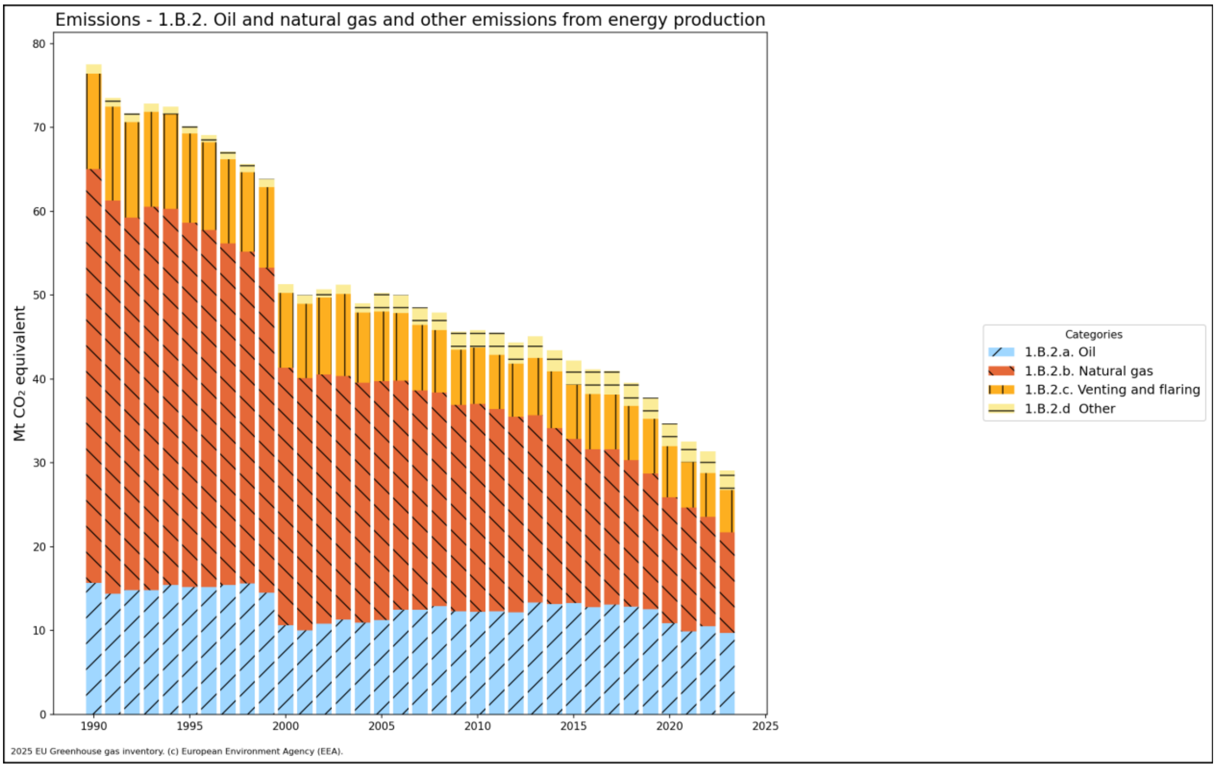
Fugitive emissions from 1.B.2 Oil and natural gas include all emissions from exploration, production, processing, transport, and handling of oil and natural gas. They account for 1 % of the total GHG emissions in 2023 and for 54 % (Figure 3.154) of all fugitive emissions in the EU.

Of all fugitive emissions from oil and natural gas, in 2023:

- 39 % were CH_4 emissions from natural gas (exploration, production, processing, transport and distribution)
- 31% were CO_2 emissions from oil (exploration, production, transport, refining and storage and distribution)
- 8 % were CO_2 emissions from venting and flaring
- 9 % were CH_4 emissions from venting and flaring

Fugitive emissions from oil and natural gas occur in all countries but Malta (Table 3.109). Total greenhouse gas emissions from 1.B.2 decreased by 62 % between 1990 and 2023 (Figure **3.154**). This trend was mainly due to the reduction of fugitive CH_4 emissions from natural gas activities, which decreased by 76 % over that period.

Figure 3.154 1.B.2-Fugitive Emissions Oil and Natural Gas: Trend



In 2023, 48% of all fugitive GHG emissions from oil and natural gas were emitted by four countries: Germany, Poland, Romania and Spain (Table 3.109).

Table 3.109   1.B.2 Fugitive emissions from oil and natural gas: Countries' contributions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
Austria	569	407	102	74	467	333
Belgium	892	551	85	74	807	477
Bulgaria	238	992	60	676	177	315
Croatia	986	453	583	304	403	148
Cyprus	0	NA,NO	NA,NO	NA,NO	0	NA,NO
Czechia	1 198	431	2	3	1 195	428
Denmark	670	182	341	88	329	94
Estonia	72	15	0	0	72	15
Finland	125	126	111	86	12	39
France	6 402	2 426	4 362	1 623	2 017	796
Germany	12 175	2 780	2 008	1 006	10 165	1 772
Greece	84	127	43	3	41	124
Hungary	2 623	1 304	478	143	2 143	1 161
Ireland	56	70	0	0	56	70
Italy	14 055	4 501	4 047	1 741	9 997	2 753
Latvia	277	102	0	0	277	102
Lithuania	321	308	24	198	297	110
Luxembourg	22	25	0	0	22	25
Malta	NO	NO	NO	NO	NO	NO
Netherlands	3 064	1 453	775	973	2 289	480
Poland	1 267	4 285	47	1 617	1 219	2 668
Portugal	58	1 082	54	1 024	2	57
Romania	27 619	3 236	1 177	796	26 439	2 440
Slovakia	2 118	463	57	33	2 060	430
Slovenia	56	39	0	0	56	39
Spain	2 101	3 673	1 738	3 444	363	228
Sweden	449	62	331	6	117	56
EU-27	**77 496**	**29 094**	**16 425**	**13 913**	**61 025**	**15 161**

Abbreviations explained in the Chapter 'Units and abbreviations'.

CO_2 from Oil (1.B.2.a)

Fugitive emissions from oil correspond to fugitive emissions from all sources associated with the exploration, production, transmission, upgrading and refining of crude oil and the distribution of crude oil products (2006 IPCC Guidelines).

CO_2 emissions from 1.B.2.a 'Fugitive emissions from oil' account for 0.3 % of total EU GHG emissions in 2023 and for 17 % of all fugitive emissions. Between 1990 and 2023, CO_2 emissions from this source increased by 4 % in the EU (Table 3.110). By contrast, during the same period 1990-2022, CH_4 emissions of this source category were reduced by 90 %.

Main contributor to these emissions in all countries is subcategory 1.B.2.a.4 (Oil – Refining/Storage). Table **3.110** shows that 86 % of EU CO_2 emissions from this source are calculated using higher tier methods. In cases where countries report a mix of Tier 1 and higher Tier methods only emissions from subcategories of sector 1.B.2.a were considered for the calculation, where the countries actually apply a higher tier method. Countries that report a Tier 1 method but a country specific or plant specific emission factor were calculated as a higher method, according to the IPCC 2006 Guidelines. For detailed information on countries methodologies please see Annex III.

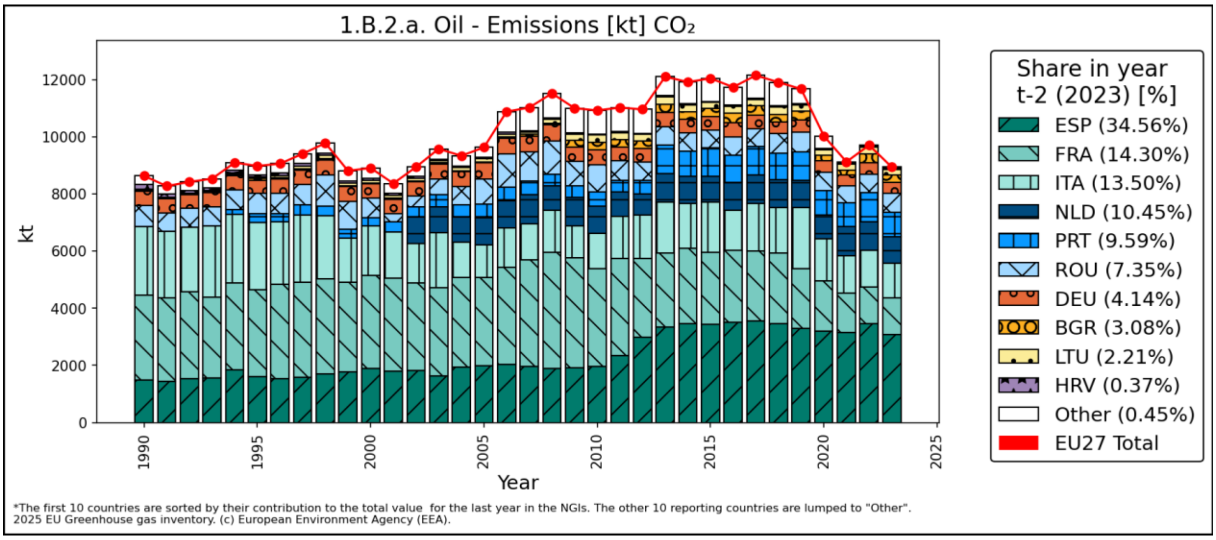
Table 3.110 shows the Member States' contributions to the EU CO_2 emissions in this category. Increases are mainly driven by the reduction of CO_2 emissions from subcategory 1.B.2.a.4 (Oil – Refining/Storage).

Table 3.110 1.B.2.a Fugitive CO_2 emissions from oil: Countries' contributions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	0.005	0.003	0.005	0.0%	0	1%	0	39%	NA,T1	D,NA
Belgium	0.01	0.02	0.02	0.0%	0	20%	0	9%	NA,T1	D,NA
Bulgaria	60	311	276	3.1%	216	362%	-35	-11%	NA,T1	D,NA
Croatia	158	34	33	0.4%	-125	-79%	-1	-3%	NA,T1	D,NA
Cyprus	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Czechia	0	0	0	0.0%	0	33%	0	-8%	NA,T1	D,NA
Denmark	5	0	0	0.0%	-5	-99%	0	6%	NA,T3	NA,PS
Estonia	NE,NO	NE,NO	NE,NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	2 983	1 301	1 279	14.3%	-1 705	-57%	-23	-2%	NA,T1,T2,T3	CS,D,NA,PS
Germany	478	383	370	4.1%	-108	-23%	-13	-3%	NA,T1,T2	CS,D,NA
Greece	0	0	0	0.0%	0	-92%	0	50%	NA,T1	D,NA
Hungary	5	0	0	0.0%	-5	-91%	0	-7%	NA,T1	CS,NA
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	2 402	1 268	1 207	13.5%	-1 195	-50%	-61	-5%	NA,T1,T2	CS,D,NA
Latvia	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Lithuania	23	237	197	2.2%	174	747%	-40	-17%	NA,T1,T3	D,NA,PS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	0	1 000	935	10.5%	935	5193397%	-65	-7%	CS,NA,T1	D,NA,PS
Poland	2	9	9	0.1%	7	410%	0	-3%	NA,T1	CS,D,NA
Portugal	0	1 015	857	9.6%	857	201412%	-158	-16%	D,NO,T1	D,NO
Romania	746	663	657	7.4%	-89	-12%	-6	-1%	NA,T1,T2,T3	CS,D,NA,PS
Slovakia	40	32	31	0.3%	-9	-23%	-1	-3%	NA,T1	D,NA
Slovenia	0	0	0	0.0%	0	120%	0	-7%	NA,T1	D,NA
Spain	1 477	3 455	3 090	34.6%	1 614	109%	-365	-11%	NA,T1,T2	D,NA,PS
Sweden	255	NA,NE,NO	NA,NE,NO	-	-255	-100%	-	-	T3	PS
EU-27	**8 633**	**9 709**	**8 941**	**100%**	**308**	**4%**	**-768**	**-8%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.155 1.B.2.a Oil: Emission trend and share for the emitting countries of CO_2



CH_4 from Oil (1.B.2.a)

CH_4 emissions from 1.B.2.a 'Fugitive emissions from oil' account for 0.03 % of total EU GHG emissions in 2023 and for 1.3 % of all fugitive emissions. Between 1990 and 2023, CH_4 emissions from this source decreased by 90 % in the EU (Table 3.110).

Table 3.111 shows the Member States contributions to the EU CH_4 emissions in this category. 39% of reported CH_4 emissions from this category are calculated with a higher tier method.

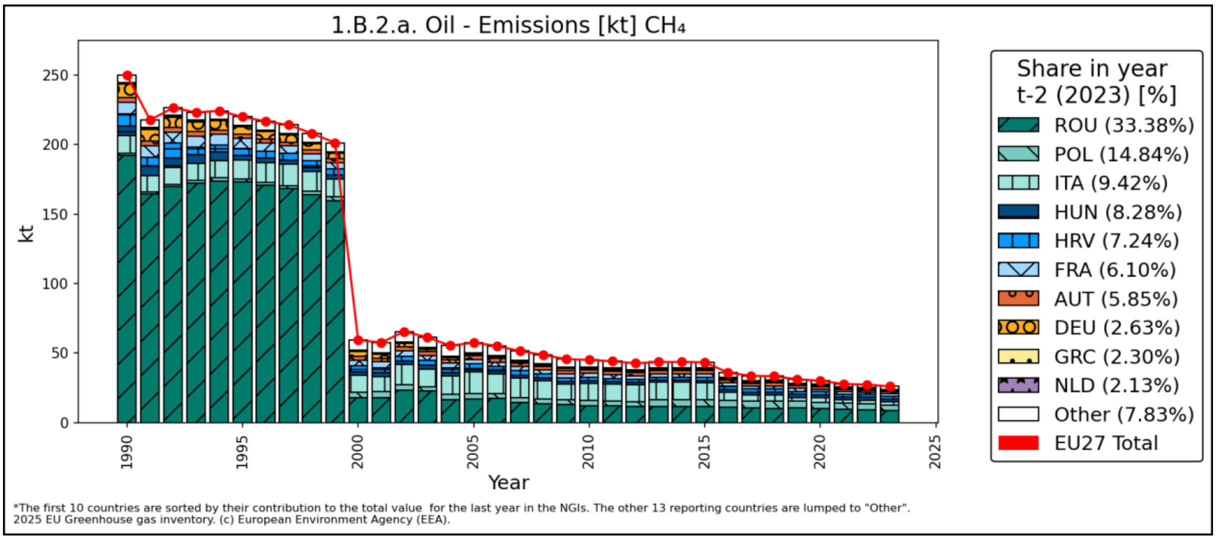
In Romania main contributions to CH_4 emissions come from subcategory 1.B.2.a.2 (Oil – Production). From 1990 to 2000 CH_4 emissions are estimated using a Tier 1 methodology with a default emission factor for developing countries of the 2006 IPCC Guidelines. From 2000 on the country applies a Tier 1 methodology with a default emission factor for developed countries, due to change of technology (ROU NID 2025). This also explains the outlier in ***Figure 3.156***. For detailed information on countries methodologies please see Annex III.

Table 3.111 1.B.2.a Fugitive CH_4 emissions from oil: Countries' contributions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	92	44	43	5.9%	-50	-54%	-1	-3%	NA,T1	D,NA
Belgium	13	8	7	1.0%	-5	-42%	0	-2%	CS,D,NA	CS,D,NA
Bulgaria	14	9	8	1.1%	-6	-40%	-1	-7%	NA,T1	D,NA
Croatia	247	55	53	7.2%	-194	-79%	-2	-4%	NA,T1	D,NA
Cyprus	0	NA,NO	NA,NO	-	0	-100%	-	-	NA	NA
Czechia	11	7	7	0.9%	-4	-39%	0	0%	NA,T1,T2	CS,D,NA
Denmark	48	11	11	1.5%	-37	-77%	0	-3%	NA,T2,T3	NA
Estonia	NE,NO	NE,NO	NE,NO	-	-	-	-	-	NA	NA
Finland	7	8	8	1.2%	1	19%	0	0%	NA,T1	D,NA
France	230	45	44	6.1%	-186	-81%	0	-1%	NA,T1,T2,T3	CS,D,NA,PS
Germany	271	23	19	2.6%	-252	-93%	-4	-18%	NA,T1,T2	CS,D,NA
Greece	11	16	17	2.3%	6	54%	1	6%	NA,T1	D,NA
Hungary	200	58	60	8.3%	-140	-70%	3	5%	NA,T1	CS,NA
Ireland	0	0	0	0.1%	0	54%	0	-7%	NA,T1	D,NA
Italy	347	79	69	9.4%	-278	-80%	-10	-13%	NA,T1,T2	CS,D,NA
Latvia	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Lithuania	5	2	2	0.3%	-2	-49%	0	4%	NA,T1	D,NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	23	16	15	2.1%	-7	-32%	-1	-4%	NA,T1,T1b	D,NA
Poland	39	115	108	14.8%	69	176%	-7	-6%	NA,T1,T2	CS,D,NA
Portugal	2	2	2	0.2%	0	-18%	0	-9%	CR,NO,OTH	CR,NO,OTH
Romania	5 389	256	243	33.4%	-5 146	-95%	-13	-5%	NA,T1	D,NA
Slovakia	13	6	6	0.8%	-7	-55%	0	-3%	NA,T1	D,NA
Slovenia	0	0	0	0.0%	0	-100%	0	0%	NA,T1	D,NA
Spain	17	4	3	0.5%	-13	-79%	0	-5%	NA,T1	D,NA
Sweden	14	1	1	0.2%	-12	-92%	0	-8%	T1,T2	CS,D,PS
EU-27	**6 993**	**765**	**728**	**100%**	**-6 265**	**-90%**	**-37**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.156: 1.B.2.a Oil: Emission trend and share for the emitting countries of CH_4



CH_4 from Natural gas (1.B.2.b)

Fugitive emissions from natural gas correspond to emissions from all fugitive sources associated with the exploration, production, processing, transmission, storage and distribution of natural gas (associated and non-associated gas) (2006 IPCC Guidelines).

CH_4 emissions from 1.B.2.b 'Fugitive emissions from natural gas' account for 0.4 % of total EU GHG emissions in 2023 and for 21 % of all fugitive emissions in the EU. Between 1990 and 2023, CH_4 emissions from this source decreased by 76 % (Table 3.112).

The main sources of CH_4 emissions are subcategories Transmission and Storage -1B2biv (19% of CH_4 emissions in category 1B2b) and Distribution - 1B2bv (53% of CH_4 emissions in category 1B2b).

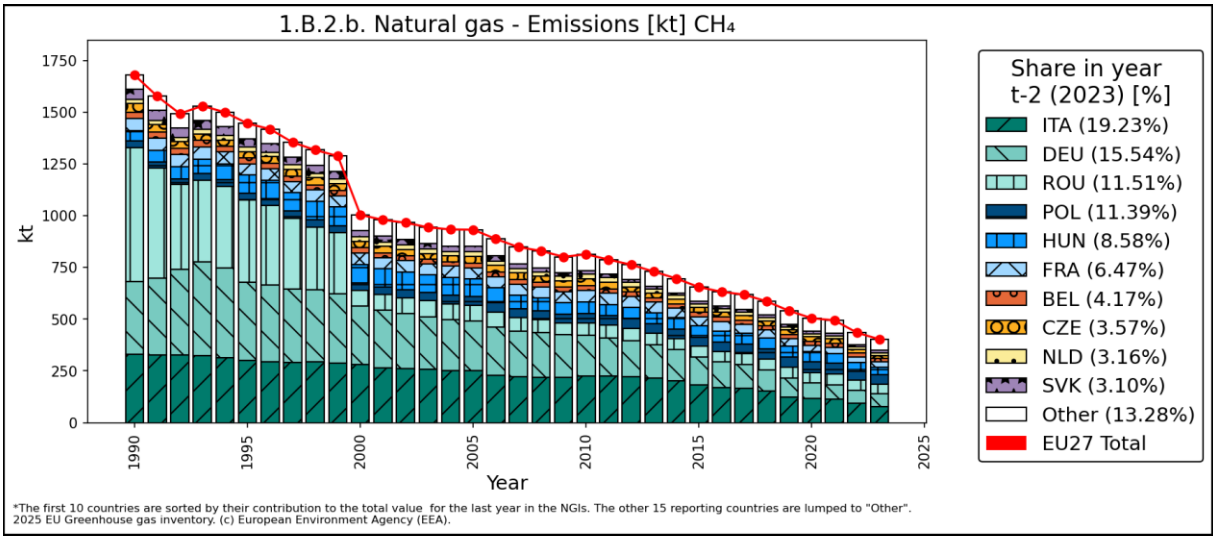
Emissions from natural gas production (1.B.2.b.2) and other operations on natural gas (1.B.2.b.6) are the main sources of CH_4 emissions in Romania in this category. From 1990 to 2000, CH_4 emissions are estimated to be using a Tier 1 methodology with a default emission factor for developing countries of the 2006 IPCC Guidelines. From 2000 on the country applies a Tier 1 methodology with a default emission factor for developed countries, due to change of technology. This also explains the outlier in Figure **3.157**. Table **3.112** shows that 69 % of EU emissions are calculated using higher tier methods. In cases where countries report a mix of Tier 1 and higher Tier methods only emissions from subcategories of sector 1.B.2.b were considered for the calculation, where the countries actually apply a higher tier method. Countries that report a Tier 1 method but a country specific or plant specific emission factor were counted as a higher Tier method, according to the IPCC 2006 Guidelines. For detailed information on countries methodologies, please see Annex III.

Table 3.112 1.B.2.b Fugitive CH_4 emissions from natural gas: Countries' contributions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	375	311	290	2.6%	-84	-22%	-20	-7%	NA,T1,T2	CS,D,NA
Belgium	795	481	470	4.2%	-325	-41%	-12	-2%	CS,NA	CS,NA
Bulgaria	164	292	307	2.7%	143	87%	14	5%	T1	D
Croatia	155	100	96	0.8%	-59	-38%	-5	-5%	NA,T1	D,NA
Cyprus	NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Czechia	1 170	485	402	3.6%	-768	-66%	-84	-17%	NA,T1,T2	CS,NA
Denmark	247	76	72	0.6%	-174	-71%	-4	-5%	NA,T1,T2	CS,D,NA
Estonia	63	15	13	0.1%	-49	-79%	-2	-11%	NA,T1	D,NA
Finland	5	17	30	0.3%	25	532%	13	72%	NA,T1,T2	CS,D,NA,PS
France	1 703	805	729	6.5%	-973	-57%	-75	-9%	NA,T2,T3	CS,NA,PS
Germany	9 893	1 785	1 753	15.5%	-8 140	-82%	-33	-2%	NA,T2,T3	CS,NA
Greece	10	87	82	0.7%	72	698%	-4	-5%	NA,T1	D,NA
Hungary	1 403	1 127	968	8.6%	-435	-31%	-160	-14%	NA,T1,T2	CS,NA
Ireland	25	70	70	0.6%	45	183%	0	0%	NA,T3	CS,NA,PS
Italy	9 225	2 596	2 169	19.2%	-7 056	-76%	-427	-16%	NA,T2	CS,NA
Latvia	199	90	87	0.8%	-111	-56%	-3	-3%	NA,T3	CS,NA
Lithuania	292	177	107	1.0%	-185	-63%	-70	-39%	NA,T2	CS,NA
Luxembourg	22	26	24	0.2%	3	12%	-2	-6%	NA,T1	D,NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	597	337	357	3.2%	-240	-40%	20	6%	NA,T3	CS,NA
Poland	844	1 273	1 284	11.4%	440	52%	11	1%	NA,T1	D,NA
Portugal	NO	56	54	0.5%	54	∞	-2	-4%	CR,NO,OTH	CR,NO,OTH
Romania	18 124	1 339	1 297	11.5%	-16 827	-93%	-41	-3%	NA,T1	D,NA
Slovakia	1 388	346	349	3.1%	-1 039	-75%	3	1%	NA,T1,T3	CS,D,M,NA
Slovenia	48	35	33	0.3%	-14	-30%	-2	-4%	NA,T1	D,NA
Spain	161	188	177	1.6%	16	10%	-11	-6%	CS,NA,T1	CS,D,NA
Sweden	103	56	55	0.5%	-48	-47%	-1	-3%	T1,T2,T3	CS,D,PS
EU-27	**47 005**	**12 171**	**11 275**	**100%**	**-35 730**	**-76%**	**-896**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.157 1.B.2.b Natural Gas: Emission trend and share for the emitting countries of CH_4



CRT Tables do not include activity data for sector 1.B.2 because countries use different types of activity data in category 1B2a and 1B2b, which cannot be aggregated. Information on the type of activity data is provided in the member states NIDs and CRT tables.

3.6.6.3 CO_2 Emissions from Venting and Flaring (1.B.2.c)

Fugitive emissions from this source correspond to Emissions from venting and flaring of associated gas and waste gas/vapour streams at oil and gas facilities.

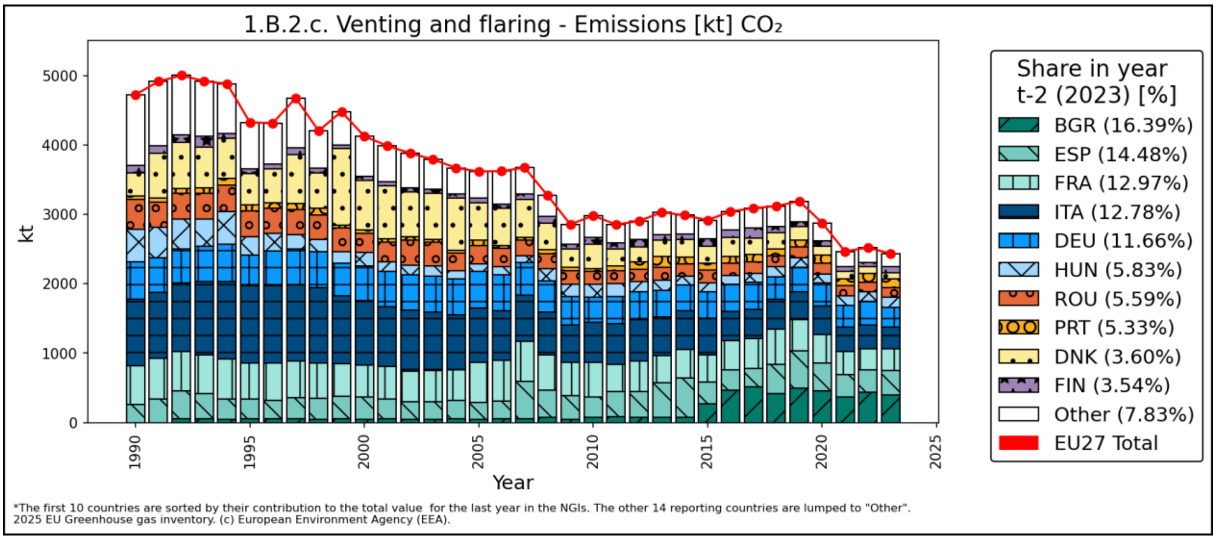
CO_2 emissions from 1.B.2.c – Venting and Flaring – account for 0.1% of total EU GHG emissions in 2023 and for 4 % of all fugitive emissions in the EU. Between 1990 and 2023 CO_2 emissions from this source decreased by 48 % (*Table 3.113*).

Table 3.113: 1.B.2.c Fugitive CO_2 emissions from Other emissions: Countries' contributions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	IE	IE	IE	-	-	-	-	-	NA	NA
Belgium	84	111	74	3.0%	-10	-12%	-37	-33%	NA,T3	NA,PS
Bulgaria	IE,NO	440	399	16.4%	399	∞	-41	-9%	NA,T1	D,NA
Croatia	0	0	0	0.0%	0	-97%	0	-26%	NA,T1	D,NA
Cyprus	NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Czechia	2	3	3	0.1%	1	41%	0	-9%	NA,T1	D,NA
Denmark	328	95	88	3.6%	-240	-73%	-7	-8%	NA,T3	NA,PS
Estonia	0	0	0	0.0%	0	-79%	0	-11%	NA,T1	D,NA
Finland	111	65	86	3.5%	-25	-22%	21	33%	CS,NA	CS,NA
France	560	302	316	13.0%	-244	-44%	13	4%	T1,T2,T3	CS,D,PS
Germany	544	347	284	11.7%	-260	-48%	-63	-18%	NA,T2	CS,NA
Greece	43	2	3	0.1%	-40	-94%	1	65%	NA,T1	D,NA
Hungary	471	134	142	5.8%	-329	-70%	8	6%	NA,T1,T3	CS,D,NA
Ireland	IE,NO	0	0	0.0%	0	∞	0	29%	CS,NA,T3	CS,NA,PS
Italy	956	336	311	12.8%	-644	-67%	-25	-7%	NA,T1	D,NA
Latvia	0	0	0	0.0%	0	-82%	0	-19%	NA,T3	CS,NA
Lithuania	1	1	1	0.0%	0	-6%	-1	-50%	NA,T1	D,NA
Luxembourg	0	0	0	0.0%	0	-16%	0	26%	CS,NA	CS,NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	774	24	38	1.6%	-736	-95%	14	57%	NA,T2	NA,PS
Poland	44	71	73	3.0%	29	67%	2	3%	NA,T1	D,NA
Portugal	52	125	130	5.3%	77	147%	5	4%	NO	NO,PS
Romania	424	142	136	5.6%	-288	-68%	-6	-4%	NA,T1	D,NA
Slovakia	0	0	0	0.0%	0	-85%	0	-58%	NA,T1	D,NA
Slovenia	0	0	0	0.0%	0	-91%	0	2%	NA,T1	D,NA
Spain	258	323	352	14.5%	94	37%	29	9%	CS,NA,T1,T2	CS,D,NA,PS
Sweden	73	0	0	0.0%	-73	-100%	0	-56%	T2,T3	CS,PS
EU-27	**4 724**	**2 520**	**2 435**	**100%**	**-2 289**	**-48%**	**-85**	**-3%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period
Austria includes CO_2 emissions from venting and flaring in 1.A.1b Petroleum refining
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.158: 1.B.2.c Venting and Flaring: Emission trend and share for the emitting countries of CO_2



3.6.6.4 Emissions from Other (1.B.2.d)

Fugitive emissions from other correspond to emissions from geothermal energy production and all other energy production that are not included in categories 1.B.1 and 1.B.2.

Fugitive emissions from this source account for 0.1% of the total EU GHG and have a share of 4% of total fugitive emissions. The description of the subcategories is presented in Table 3.114.

Table 3.114 Description of subcategories in sector 1.B.2.d for CO_2-, N_2O- and CH_4-emissions for reporting countries

Member state	Emission	Subcategory
Finland	CO_2, CH_4	Distribution of town gas
Greece	CO_2, N_2O	LPG transport
Hungary	CH_4, CO_2	Groundwater extraction and CO_2 mining
Italy	CH_4, CO_2, N_2O	Flaring in refineries
Poland	CO_2	Underground storage of gas
Portugal	CO_2	Geothermal

3.6.7 CO_2 capture and storage (1.C)

CO_2 capture and storage is not an EU key category (see Annex 1.1). Finland is the only Member State reporting captured CO_2 emissions in this category for the years 1993 to 2023.

The amount of CO_2 captured reflects the CO_2 captured in pulp and paper mills in Finland, where precipitated calcium carbonate (PCC) is formed and then used in the paper and paperboard industry. The final use of the CO_2 captured is considered as long-term storage except if the products are combusted. The resulting fossil CO_2 emissions from combustion of products containing PCC are considered in the corresponding categories in the greenhouse gas inventory of Finland. A detailed description of the methodology is provided in Finland's NIR.

Captured CO_2 emissions reported in 1C 'CO_2 capture and storage' correspond to 0.002 % of total EU GHG emissions in 2023. The emissions captured increased between 1993 and 2023 by 5 548 %.

3.6.8 Energy – non-key categories

Table 3.115 provides an overview on the role of non-key categories in the Energy sector.

Table 3.115 Aggregated GHG emission from non-key categories in the energy sector

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.1.a. Public Electricity and Heat Production: Biomass (CH_4)	39.6	2 142.3	1 992.6	0.07%	1 953.0	4928%	-149.7	-7%
1.A.1.a. Public Electricity and Heat Production: Biomass (N_2O)	203.3	1 352.7	1 272.8	0.05%	1 069.4	526%	-79.9	-6%
1.A.1.a. Public Electricity and Heat Production: Gaseous Fuels (CH_4)	180.2	1 230.5	1 218.4	0.05%	1 038.1	576%	-12.1	-1%
1.A.1.a. Public Electricity and Heat Production: Gaseous Fuels (N_2O)	134.1	799.9	623.7	0.02%	489.7	365%	-176.1	-22%
1.A.1.a. Public Electricity and Heat Production: Liquid Fuels (CH_4)	157.3	29.0	25.3	0.00%	-132.0	-84%	-3.8	-13%
1.A.1.a. Public Electricity and Heat Production: Liquid Fuels (N_2O)	332.6	74.0	63.2	0.00%	-269.4	-81%	-10.8	-15%
1.A.1.a. Public Electricity and Heat Production: Other Fuels (CH_4)	17.3	42.0	41.0	0.00%	23.7	137%	-0.9	-2%
1.A.1.a. Public Electricity and Heat Production: Other Fuels (N_2O)	115.4	272.7	270.2	0.01%	154.9	134%	-2.5	-1%
1.A.1.a. Public Electricity and Heat Production: Peat (CH_4)	9.2	5.8	4.9	0.00%	-4.3	-47%	-0.8	-14%
1.A.1.a. Public Electricity and Heat Production: Peat (N_2O)	110.3	48.3	30.0	0.00%	-80.3	-73%	-18.3	-38%
1.A.1.a. Public Electricity and Heat Production: Solid Fuels (CH_4)	193.3	85.3	59.8	0.00%	-133.5	-69%	-25.5	-30%
1.A.1.a. Public Electricity and Heat Production: Solid Fuels (N_2O)	4 387.0	2 280.1	1 665.2	0.06%	-2 721.8	-62%	-615.0	-27%
1.A.1.b. Petroleum Refining: Biomass (CH_4)	2.1	0.1	0.2	0.00%	-1.9	-92%	0.0	34%
1.A.1.b. Petroleum Refining: Biomass (N_2O)	3.1	1.2	1.2	0.00%	-1.9	-62%	0.0	-2%
1.A.1.b. Petroleum Refining: Gaseous Fuels (CH_4)	6.4	13.1	14.9	0.00%	8.5	134%	1.9	14%
1.A.1.b. Petroleum Refining: Gaseous Fuels (N_2O)	120.3	15.9	17.8	0.00%	-102.5	-85%	1.9	12%
1.A.1.b. Petroleum Refining: Liquid Fuels (CH_4)	68.6	52.7	50.7	0.00%	-17.9	-26%	-2.1	-4%
1.A.1.b. Petroleum Refining: Liquid Fuels (N_2O)	248.2	247.9	223.8	0.01%	-24.4	-10%	-24.2	-10%
1.A.1.b. Petroleum Refining: Other Fuels (CH_4)	6.5	0.2	0.2	0.00%	-6.3	-96%	0.0	-6%
1.A.1.b. Petroleum Refining: Other Fuels (CO_2)	920.7	203.6	244.4	0.01%	-676.3	-73%	40.8	20%
1.A.1.b. Petroleum Refining: Other Fuels (N_2O)	8.6	0.5	0.5	0.00%	-8.2	-95%	-0.1	-17%
1.A.1.b. Petroleum Refining: Peat (CH_4)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.1.b. Petroleum Refining: Peat (CO_2)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.1.b. Petroleum Refining: Peat (N_2O)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.1.b. Petroleum Refining: Solid Fuels (CH_4)	0.6	0.0	0.0	0.00%	-0.6	-93%	0.0	919%
1.A.1.b. Petroleum Refining: Solid Fuels (CO_2)	3 633.0	60.3	244.5	0.01%	-3 388.5	-93%	184.2	306%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.1.b. Petroleum Refining: Solid Fuels (N_2O)	26.6	0.3	0.9	0.00%	-25.8	-97%	0.6	222%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Biomass (CH_4)	147.0	134.5	124.9	0.00%	-22.1	-15%	-9.6	-7%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Biomass (N_2O)	4.3	41.1	40.5	0.00%	36.2	848%	-0.6	-2%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Gaseous Fuels (CH_4)	76.3	19.9	36.4	0.00%	-39.9	-52%	16.5	83%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Gaseous Fuels (N_2O)	15.9	23.5	21.5	0.00%	5.6	35%	-2.0	-9%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Liquid Fuels (CH_4)	3.8	1.0	1.2	0.00%	-2.6	-69%	0.2	16%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Liquid Fuels (CO_2)	3 139.8	979.0	1 131.3	0.04%	-2 008.4	-64%	152.3	16%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Liquid Fuels (N_2O)	12.7	1.9	2.3	0.00%	-10.5	-82%	0.3	17%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Other Fuels (CH_4)	5.5	0.0	0.0	0.00%	-5.5	-100%	0.0	-100%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Other Fuels (CO_2)	456.1	0.1	0.0	0.00%	-456.1	-100%	-0.1	-100%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Other Fuels (N_2O)	8.1	0.0	0.0	0.00%	-8.1	-100%	0.0	-100%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Peat (CH_4)	0.1	0.0	0.0	0.00%	0.0	-76%	0.0	-48%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Peat (CO_2)	175.5	66.8	37.4	0.00%	-138.0	-79%	-29.4	-44%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Peat (N_2O)	0.6	0.2	0.1	0.00%	-0.5	-78%	-0.1	-44%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Solid Fuels (CH_4)	174.2	14.5	15.5	0.00%	-158.8	-91%	1.0	7%
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries: Solid Fuels (N_2O)	612.8	95.3	83.7	0.00%	-529.1	-86%	-11.6	-12%
1.A.2.a. Iron and Steel: Biomass (CH_4)	0.3	0.2	1.2	0.00%	0.9	309%	1.0	402%
1.A.2.a. Iron and Steel: Biomass (N_2O)	0.4	0.6	1.6	0.00%	1.2	336%	1.1	186%
1.A.2.a. Iron and Steel: Gaseous Fuels (CH_4)	20.6	13.0	21.5	0.00%	0.9	4%	8.5	65%
1.A.2.a. Iron and Steel: Gaseous Fuels (N_2O)	111.0	39.4	38.7	0.00%	-72.4	-65%	-0.7	-2%
1.A.2.a. Iron and Steel: Liquid Fuels (CH_4)	14.1	0.6	0.5	0.00%	-13.6	-96%	0.0	-6%
1.A.2.a. Iron and Steel: Liquid Fuels (N_2O)	26.0	2.7	2.6	0.00%	-23.4	-90%	-0.1	-3%
1.A.2.a. Iron and Steel: Other Fuels (CH_4)	4.1	0.0	0.1	0.00%	-4.1	-98%	0.0	165%
1.A.2.a. Iron and Steel: Other Fuels (CO_2)	655.4	8.8	16.1	0.00%	-639.3	-98%	7.3	84%
1.A.2.a. Iron and Steel: Other Fuels (N_2O)	5.2	0.0	0.1	0.00%	-5.1	-98%	0.1	159%
1.A.2.a. Iron and Steel: Peat (CH_4)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.2.a. Iron and Steel: Peat (CO_2)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.2.a. Iron and Steel: Peat (N_2O)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.2.a. Iron and Steel: Solid Fuels (CH_4)	240.0	117.7	105.4	0.00%	-134.6	-56%	-12.3	-10%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.2.a. Iron and Steel: Solid Fuels (N_2O)	297.2	131.0	119.6	0.00%	-177.6	-60%	-11.4	-9%
1.A.2.b. Non-Ferrous Metals: Biomass (CH_4)	0.0	1.2	0.6	0.00%	0.6	17406%	-0.6	-49%
1.A.2.b. Non-Ferrous Metals: Biomass (N_2O)	0.0	1.5	0.8	0.00%	0.8	18599%	-0.7	-47%
1.A.2.b. Non-Ferrous Metals: Gaseous Fuels (CH_4)	2.2	20.3	7.3	0.00%	5.0	225%	-13.0	-64%
1.A.2.b. Non-Ferrous Metals: Gaseous Fuels (N_2O)	4.1	8.2	7.2	0.00%	3.0	74%	-1.0	-12%
1.A.2.b. Non-Ferrous Metals: Liquid Fuels (CH_4)	4.2	0.7	0.8	0.00%	-3.4	-80%	0.2	23%
1.A.2.b. Non-Ferrous Metals: Liquid Fuels (CO_2)	4 189.7	785.6	986.7	0.04%	-3 203.0	-76%	201.0	26%
1.A.2.b. Non-Ferrous Metals: Liquid Fuels (N_2O)	10.7	3.0	3.3	0.00%	-7.4	-69%	0.3	10%
1.A.2.b. Non-Ferrous Metals: Other Fuels (CH_4)	0.4	0.0	0.0	0.00%	-0.4	-99%	0.0	10%
1.A.2.b. Non-Ferrous Metals: Other Fuels (CO_2)	64.9	0.5	0.6	0.00%	-64.3	-99%	0.0	8%
1.A.2.b. Non-Ferrous Metals: Other Fuels (N_2O)	0.5	0.0	0.0	0.00%	-0.5	-98%	0.0	11%
1.A.2.b. Non-Ferrous Metals: Peat (CH_4)	0.0	0.0	0.0	0.00%	0.0	-100%	0.0	0%
1.A.2.b. Non-Ferrous Metals: Peat (CO_2)	6.5	0.0	0.0	0.00%	-6.5	-100%	0.0	0%
1.A.2.b. Non-Ferrous Metals: Peat (N_2O)	0.0	0.0	0.0	0.00%	0.0	-100%	0.0	0%
1.A.2.b. Non-Ferrous Metals: Solid Fuels (CH_4)	9.7	2.9	2.3	0.00%	-7.4	-77%	-0.6	-22%
1.A.2.b. Non-Ferrous Metals: Solid Fuels (CO_2)	4 687.4	1 220.9	1 065.8	0.04%	-3 621.6	-77%	-155.1	-13%
1.A.2.b. Non-Ferrous Metals: Solid Fuels (N_2O)	25.5	4.6	3.9	0.00%	-21.6	-85%	-0.7	-15%
1.A.2.c. Chemicals: Biomass (CH_4)	1.7	18.6	11.5	0.00%	9.8	570%	-7.0	-38%
1.A.2.c. Chemicals: Biomass (N_2O)	7.2	30.2	21.6	0.00%	14.4	199%	-8.6	-28%
1.A.2.c. Chemicals: Gaseous Fuels (CH_4)	55.8	361.9	337.6	0.01%	281.8	505%	-24.3	-7%
1.A.2.c. Chemicals: Gaseous Fuels (N_2O)	40.5	41.0	38.5	0.00%	-2.0	-5%	-2.5	-6%
1.A.2.c. Chemicals: Liquid Fuels (CH_4)	36.9	12.7	9.2	0.00%	-27.7	-75%	-3.4	-27%
1.A.2.c. Chemicals: Liquid Fuels (N_2O)	131.0	65.0	47.7	0.00%	-83.3	-64%	-17.3	-27%
1.A.2.c. Chemicals: Other Fuels (CH_4)	17.1	8.4	7.6	0.00%	-9.5	-55%	-0.8	-9%
1.A.2.c. Chemicals: Other Fuels (CO_2)	3 026.8	1 318.0	1 254.2	0.05%	-1 772.6	-59%	-63.8	-5%
1.A.2.c. Chemicals: Other Fuels (N_2O)	24.1	17.2	15.5	0.00%	-8.6	-36%	-1.7	-10%
1.A.2.c. Chemicals: Peat (CH_4)	0.2	0.0	0.0	0.00%	-0.2	-100%	0.0	0%
1.A.2.c. Chemicals: Peat (CO_2)	191.1	0.0	0.0	0.00%	-191.1	-100%	0.0	0%
1.A.2.c. Chemicals: Peat (N_2O)	3.4	0.0	0.0	0.00%	-3.4	-100%	0.0	0%
1.A.2.c. Chemicals: Solid Fuels (CH_4)	28.2	24.0	34.7	0.00%	6.5	23%	10.7	44%
1.A.2.c. Chemicals: Solid Fuels (N_2O)	63.3	34.1	30.3	0.00%	-33.0	-52%	-3.8	-11%
1.A.2.d. Pulp, Paper and Print: Biomass (CH_4)	52.0	136.0	136.0	0.01%	84.0	162%	0.0	0%
1.A.2.d. Pulp, Paper and Print: Biomass (N_2O)	171.8	330.3	343.0	0.01%	171.2	100%	12.7	4%
1.A.2.d. Pulp, Paper and Print: Gaseous Fuels (CH_4)	35.9	92.5	84.4	0.00%	48.5	135%	-8.1	-9%
1.A.2.d. Pulp, Paper and Print: Gaseous Fuels (N_2O)	25.7	37.7	29.7	0.00%	4.0	16%	-8.0	-21%
1.A.2.d. Pulp, Paper and Print: Liquid Fuels (CH_4)	13.2	8.0	7.6	0.00%	-5.7	-43%	-0.4	-5%
1.A.2.d. Pulp, Paper and Print: Liquid Fuels (N_2O)	32.7	7.6	6.6	0.00%	-26.1	-80%	-1.0	-13%
1.A.2.d. Pulp, Paper and Print: Other Fuels (CH_4)	0.4	4.7	5.6	0.00%	5.3	1480%	1.0	21%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.2.d. Pulp, Paper and Print: Other Fuels (CO_2)	57.8	561.2	542.3	0.02%	484.5	838%	-18.9	-3%
1.A.2.d. Pulp, Paper and Print: Other Fuels (N_2O)	0.6	7.1	8.0	0.00%	7.4	1272%	0.9	13%
1.A.2.d. Pulp, Paper and Print: Peat (CH_4)	0.7	0.3	0.2	0.00%	-0.5	-74%	-0.1	-34%
1.A.2.d. Pulp, Paper and Print: Peat (CO_2)	1 117.6	379.4	262.9	0.01%	-854.7	-76%	-116.5	-31%
1.A.2.d. Pulp, Paper and Print: Peat (N_2O)	8.7	2.4	1.6	0.00%	-7.2	-82%	-0.8	-34%
1.A.2.d. Pulp, Paper and Print: Solid Fuels (CH_4)	15.7	4.0	2.6	0.00%	-13.1	-83%	-1.4	-35%
1.A.2.d. Pulp, Paper and Print: Solid Fuels (N_2O)	35.3	24.7	6.8	0.00%	-28.5	-81%	-17.9	-72%
1.A.2.e. Food Processing, Beverages and Tobacco: Biomass (CH_4)	7.5	273.6	263.7	0.01%	256.2	3414%	-9.8	-4%
1.A.2.e. Food Processing, Beverages and Tobacco: Biomass (N_2O)	14.5	95.1	95.6	0.00%	81.1	560%	0.5	1%
1.A.2.e. Food Processing, Beverages and Tobacco: Gaseous Fuels (CH_4)	21.0	191.9	209.3	0.01%	188.3	898%	17.4	9%
1.A.2.e. Food Processing, Beverages and Tobacco: Gaseous Fuels (N_2O)	15.0	27.5	27.9	0.00%	12.9	86%	0.4	1%
1.A.2.e. Food Processing, Beverages and Tobacco: Liquid Fuels (CH_4)	18.6	3.3	3.1	0.00%	-15.5	-84%	-0.2	-7%
1.A.2.e. Food Processing, Beverages and Tobacco: Liquid Fuels (N_2O)	66.4	10.0	9.7	0.00%	-56.7	-85%	-0.2	-2%
1.A.2.e. Food Processing, Beverages and Tobacco: Other Fuels (CH_4)	0.0	0.8	0.6	0.00%	0.6	1758%	-0.2	-27%
1.A.2.e. Food Processing, Beverages and Tobacco: Other Fuels (CO_2)	4.8	87.5	63.7	0.00%	59.0	1236%	-23.8	-27%
1.A.2.e. Food Processing, Beverages and Tobacco: Other Fuels (N_2O)	0.0	1.0	0.7	0.00%	0.7	1564%	-0.3	-27%
1.A.2.e. Food Processing, Beverages and Tobacco: Peat (CH_4)	0.3	0.0	0.0	0.00%	-0.3	-100%	0.0	0%
1.A.2.e. Food Processing, Beverages and Tobacco: Peat (CO_2)	139.1	0.0	0.0	0.00%	-139.1	-100%	0.0	0%
1.A.2.e. Food Processing, Beverages and Tobacco: Peat (N_2O)	1.3	0.0	0.0	0.00%	-1.3	-100%	0.0	0%
1.A.2.e. Food Processing, Beverages and Tobacco: Solid Fuels (CH_4)	32.4	8.1	7.7	0.00%	-24.7	-76%	-0.4	-5%
1.A.2.e. Food Processing, Beverages and Tobacco: Solid Fuels (N_2O)	55.8	13.4	12.9	0.00%	-42.9	-77%	-0.5	-4%
1.A.2.f. Non-metallic minerals: Biomass (CH_4)	24.5	72.1	69.2	0.00%	44.7	183%	-2.9	-4%
1.A.2.f. Non-metallic minerals: Biomass (N_2O)	49.0	128.7	123.7	0.00%	74.7	152%	-5.1	-4%
1.A.2.f. Non-metallic minerals: Gaseous Fuels (CH_4)	29.8	79.2	70.6	0.00%	40.8	137%	-8.6	-11%
1.A.2.f. Non-metallic minerals: Gaseous Fuels (N_2O)	122.0	127.2	117.4	0.00%	-4.5	-4%	-9.7	-8%
1.A.2.f. Non-metallic minerals: Liquid Fuels (CH_4)	59.9	29.5	28.2	0.00%	-31.7	-53%	-1.3	-4%
1.A.2.f. Non-metallic minerals: Liquid Fuels (N_2O)	635.7	324.8	285.4	0.01%	-350.3	-55%	-39.4	-12%
1.A.2.f. Non-metallic minerals: Other Fuels (CH_4)	4.9	86.0	81.9	0.00%	77.0	1587%	-4.1	-5%
1.A.2.f. Non-metallic minerals: Other Fuels (N_2O)	12.5	190.1	169.4	0.01%	156.9	1256%	-20.7	-11%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.2.f. Non-metallic minerals: Peat (CH_4)	0.0	0.0	0.0	0.00%	0.0	-67%	0.0	141%
1.A.2.f. Non-metallic minerals: Peat (CO_2)	26.9	4.2	10.2	0.00%	-16.7	-62%	5.9	141%
1.A.2.f. Non-metallic minerals: Peat (N_2O)	0.1	0.0	0.1	0.00%	-0.1	-48%	0.0	141%
1.A.2.f. Non-metallic minerals: Solid Fuels (CH_4)	138.4	26.2	20.2	0.00%	-118.2	-85%	-6.0	-23%
1.A.2.f. Non-metallic minerals: Solid Fuels (N_2O)	392.7	84.6	68.2	0.00%	-324.4	-83%	-16.4	-19%
1.A.2.g. Other: Biomass (CH_4)	100.8	206.8	218.4	0.01%	117.6	117%	11.6	6%
1.A.2.g. Other: Biomass (N_2O)	172.2	338.9	365.8	0.01%	193.6	112%	26.9	8%
1.A.2.g. Other: Gaseous Fuels (CH_4)	80.3	323.0	305.7	0.01%	225.3	281%	-17.3	-5%
1.A.2.g. Other: Gaseous Fuels (N_2O)	141.0	215.2	204.2	0.01%	63.3	45%	-11.0	-5%
1.A.2.g. Other: Liquid Fuels (CH_4)	105.5	36.4	34.3	0.00%	-71.3	-68%	-2.1	-6%
1.A.2.g. Other: Liquid Fuels (N_2O)	953.8	713.0	674.5	0.03%	-279.3	-29%	-38.5	-5%
1.A.2.g. Other: Other Fuels (CH_4)	13.3	6.3	6.8	0.00%	-6.5	-49%	0.5	8%
1.A.2.g. Other: Other Fuels (N_2O)	25.7	45.7	48.4	0.00%	22.8	89%	2.7	6%
1.A.2.g. Other: Peat (CH_4)	0.1	0.0	0.0	0.00%	0.0	-22%	0.0	21%
1.A.2.g. Other: Peat (CO_2)	21.5	27.5	39.5	0.00%	18.1	84%	12.1	44%
1.A.2.g. Other: Peat (N_2O)	0.2	0.2	0.2	0.00%	0.0	10%	0.1	34%
1.A.2.g. Other: Solid Fuels (CH_4)	122.3	7.8	5.9	0.00%	-116.4	-95%	-1.9	-25%
1.A.2.g. Other: Solid Fuels (N_2O)	644.9	111.4	83.8	0.00%	-561.2	-87%	-27.7	-25%
1.A.3.a. Domestic Aviation: Aviation Gasoline (CH_4)	2.4	0.8	0.6	0.00%	-1.8	-74%	-0.1	-17%
1.A.3.a. Domestic Aviation: Aviation Gasoline (CO_2)	445.9	132.0	117.0	0.00%	-329.0	-74%	-15.0	-11%
1.A.3.a. Domestic Aviation: Aviation Gasoline (N_2O)	6.6	2.8	2.5	0.00%	-4.1	-62%	-0.3	-11%
1.A.3.a. Domestic Aviation: Biomass (CH_4)	0.0	0.0	0.0	0.00%	0.0	100%	0.0	19%
1.A.3.a. Domestic Aviation: Biomass (N_2O)	0.0	0.1	0.2	0.00%	0.2	100%	0.0	28%
1.A.3.a. Domestic Aviation: Jet Kerosene (CH_4)	7.5	6.3	5.6	0.00%	-1.9	-25%	-0.7	-12%
1.A.3.a. Domestic Aviation: Jet Kerosene (N_2O)	91.0	98.7	99.4	0.00%	8.4	9%	0.7	1%
1.A.3.b. Road Transportation: Biomass (CH_4)	0.0	63.7	67.9	0.00%	67.9	729754%	4.2	7%
1.A.3.b. Road Transportation: Biomass (N_2O)	0.1	519.9	547.7	0.02%	547.6	435011%	27.9	5%
1.A.3.b. Road Transportation: Diesel Oil (CH_4)	547.9	208.2	198.0	0.01%	-349.9	-64%	-10.2	-5%
1.A.3.b. Road Transportation: Gaseous Fuels (CH_4)	10.4	63.3	63.9	0.00%	53.5	512%	0.5	1%
1.A.3.b. Road Transportation: Gaseous Fuels (N_2O)	1.3	21.7	20.9	0.00%	19.6	1467%	-0.8	-4%
1.A.3.b. Road Transportation: Gasoline (N_2O)	3 383.9	572.8	593.9	0.02%	-2 790.1	-82%	21.1	4%
1.A.3.b. Road Transportation: Liquefied Petroleum Gases (LPG) (CH_4)	47.3	57.2	56.9	0.00%	9.7	20%	-0.3	-1%
1.A.3.b. Road Transportation: Liquefied Petroleum Gases (LPG) (N_2O)	15.7	80.5	77.0	0.00%	61.4	391%	-3.5	-4%
1.A.3.b. Road Transportation: Other Fuels (CH_4)	0.0	5.3	4.1	0.00%	4.1	100%	-1.2	-23%
1.A.3.b. Road Transportation: Other Fuels (N_2O)	0.0	17.2	16.0	0.00%	16.0	100%	-1.1	-6%
1.A.3.b. Road Transportation: Other Liquid Fuels (CH_4)	1.1	0.0	0.0	0.00%	-1.0	-96%	0.0	-9%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.3.b. Road Transportation: Other Liquid Fuels (CO_2)	439.7	64.9	60.4	0.00%	-379.3	-86%	-4.5	-7%
1.A.3.b. Road Transportation: Other Liquid Fuels (N_2O)	0.3	0.4	0.3	0.00%	0.0	-1%	0.0	-11%
1.A.3.c. Railways: Biomass (CH_4)	0.0	0.2	0.2	0.00%	0.2	1748636%	0.0	0%
1.A.3.c. Railways: Biomass (N_2O)	0.0	1.8	1.7	0.00%	1.7	100%	-0.1	-4%
1.A.3.c. Railways: Gaseous Fuels (CH_4)	0.0	0.0	0.0	0.00%	0.0	100%	0.0	-2%
1.A.3.c. Railways: Gaseous Fuels (CO_2)	0.0	7.1	7.0	0.00%	7.0	100%	-0.2	-2%
1.A.3.c. Railways: Gaseous Fuels (N_2O)	0.0	0.1	0.1	0.00%	0.1	100%	0.0	-2%
1.A.3.c. Railways: Liquid Fuels (CH_4)	19.1	4.8	4.6	0.00%	-14.5	-76%	-0.2	-3%
1.A.3.c. Railways: Liquid Fuels (N_2O)	596.4	141.9	139.1	0.01%	-457.3	-77%	-2.7	-2%
1.A.3.c. Railways: Other Fuels (CH_4)	0.0	0.0	0.0	0.00%	0.0	100%	0.0	-3%
1.A.3.c. Railways: Other Fuels (CO_2)	0.0	5.9	5.7	0.00%	5.7	100%	-0.2	-3%
1.A.3.c. Railways: Other Fuels (N_2O)	0.0	0.0	0.0	0.00%	0.0	100%	0.0	1%
1.A.3.c. Railways: Solid Fuels (CH_4)	17.1	0.8	0.6	0.00%	-16.4	-96%	-0.1	-19%
1.A.3.c. Railways: Solid Fuels (CO_2)	663.3	32.4	32.0	0.00%	-631.3	-95%	-0.4	-1%
1.A.3.c. Railways: Solid Fuels (N_2O)	2.8	0.1	0.1	0.00%	-2.7	-95%	0.0	-1%
1.A.3.d. Domestic Navigation: Biomass (CH_4)	0.0	3.1	3.2	0.00%	3.2	100%	0.1	3%
1.A.3.d. Domestic Navigation: Biomass (N_2O)	0.0	1.8	1.8	0.00%	1.8	100%	0.1	3%
1.A.3.d. Domestic Navigation: Gas/Diesel Oil (CH_4)	27.1	19.7	19.2	0.00%	-7.9	-29%	-0.5	-3%
1.A.3.d. Domestic Navigation: Gas/Diesel Oil (N_2O)	195.8	167.3	172.2	0.01%	-23.7	-12%	4.9	3%
1.A.3.d. Domestic Navigation: Gaseous Fuels (CH_4)	0.0	27.9	20.6	0.00%	20.6	100%	-7.3	-26%
1.A.3.d. Domestic Navigation: Gaseous Fuels (CO_2)	0.0	102.0	79.7	0.00%	79.7	100%	-22.3	-22%
1.A.3.d. Domestic Navigation: Gaseous Fuels (N_2O)	0.0	0.4	0.5	0.00%	0.5	100%	0.1	16%
1.A.3.d. Domestic Navigation: Gasoline (CH_4)	48.7	30.8	30.5	0.00%	-18.2	-37%	-0.3	-1%
1.A.3.d. Domestic Navigation: Gasoline (CO_2)	1 546.2	1 311.4	1 310.1	0.05%	-236.0	-15%	-1.3	0%
1.A.3.d. Domestic Navigation: Gasoline (N_2O)	6.0	6.8	6.9	0.00%	0.9	14%	0.0	0%
1.A.3.d. Domestic Navigation: Other Fuels (CH_4)	0.0	0.5	0.3	0.00%	0.3	100%	-0.2	-40%
1.A.3.d. Domestic Navigation: Other Fuels (CO_2)	0.0	25.7	16.1	0.00%	16.1	100%	-9.6	-37%
1.A.3.d. Domestic Navigation: Other Fuels (N_2O)	0.0	0.1	0.1	0.00%	0.1	100%	-0.1	-37%
1.A.3.d. Domestic Navigation: Other Liquid Fuels (CH_4)	0.2	0.3	0.3	0.00%	0.1	74%	0.0	-1%
1.A.3.d. Domestic Navigation: Other Liquid Fuels (CO_2)	12.4	34.1	31.8	0.00%	19.4	156%	-2.3	-7%
1.A.3.d. Domestic Navigation: Other Liquid Fuels (N_2O)	0.1	0.2	0.2	0.00%	0.1	116%	0.0	-7%
1.A.3.d. Domestic Navigation: Residual Fuel Oil (CH_4)	18.4	14.5	12.5	0.00%	-5.9	-32%	-2.0	-14%
1.A.3.d. Domestic Navigation: Residual Fuel Oil (N_2O)	55.4	40.8	35.4	0.00%	-20.0	-36%	-5.4	-13%
1.A.3.e. Other Transportation: Biomass (CH_4)	0.0	0.0	0.0	0.00%	0.0	100%	0.0	-41%
1.A.3.e. Other Transportation: Biomass (N_2O)	0.0	0.8	0.7	0.00%	0.7	100%	0.0	-6%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.3.e. Other Transportation: Gaseous Fuels (CH_4)	11.1	10.2	8.3	0.00%	-2.8	-25%	-1.8	-18%
1.A.3.e. Other Transportation: Gaseous Fuels (CO_2)	4 591.5	4 114.6	3 284.0	0.12%	-1 307.5	-28%	-830.6	-20%
1.A.3.e. Other Transportation: Gaseous Fuels (N_2O)	21.0	25.7	21.8	0.00%	0.8	4%	-3.9	-15%
1.A.3.e. Other Transportation: Liquid Fuels (CH_4)	2.2	0.4	0.4	0.00%	-1.9	-84%	0.0	-5%
1.A.3.e. Other Transportation: Liquid Fuels (CO_2)	1 410.8	866.3	855.7	0.03%	-555.0	-39%	-10.5	-1%
1.A.3.e. Other Transportation: Liquid Fuels (N_2O)	31.3	12.1	11.9	0.00%	-19.4	-62%	-0.3	-2%
1.A.3.e. Other Transportation: Other Fuels (CH_4)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.3.e. Other Transportation: Other Fuels (CO_2)	0.0	0.6	0.7	0.00%	0.7	100%	0.1	16%
1.A.3.e. Other Transportation: Other Fuels (N_2O)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.A.3.e. Other Transportation: Solid Fuels (CH_4)	0.5	0.0	0.0	0.00%	-0.5	-100%	0.0	0%
1.A.3.e. Other Transportation: Solid Fuels (CO_2)	54.7	0.0	0.0	0.00%	-54.7	-100%	0.0	0%
1.A.3.e. Other Transportation: Solid Fuels (N_2O)	0.6	0.0	0.0	0.00%	-0.6	-100%	0.0	0%
1.A.4.a. Commercial/Institutional: Biomass (CH_4)	160.1	460.5	449.5	0.02%	289.4	181%	-11.0	-2%
1.A.4.a. Commercial/Institutional: Biomass (N_2O)	37.2	159.8	160.1	0.01%	122.9	330%	0.3	0%
1.A.4.a. Commercial/Institutional: Gaseous Fuels (CH_4)	102.0	184.8	185.5	0.01%	83.5	82%	0.8	0%
1.A.4.a. Commercial/Institutional: Gaseous Fuels (N_2O)	87.3	120.6	123.0	0.00%	35.6	41%	2.4	2%
1.A.4.a. Commercial/Institutional: Liquid Fuels (CH_4)	147.4	85.3	58.7	0.00%	-88.7	-60%	-26.6	-31%
1.A.4.a. Commercial/Institutional: Liquid Fuels (N_2O)	257.6	80.6	79.2	0.00%	-178.4	-69%	-1.4	-2%
1.A.4.a. Commercial/Institutional: Other Fuels (CH_4)	9.5	24.4	29.9	0.00%	20.4	215%	5.5	22%
1.A.4.a. Commercial/Institutional: Other Fuels (N_2O)	16.0	137.4	144.2	0.01%	128.2	803%	6.8	5%
1.A.4.a. Commercial/Institutional: Peat (CH_4)	0.7	0.2	0.2	0.00%	-0.5	-70%	0.0	-2%
1.A.4.a. Commercial/Institutional: Peat (CO_2)	232.8	42.9	39.4	0.00%	-193.5	-83%	-3.5	-8%
1.A.4.a. Commercial/Institutional: Peat (N_2O)	0.9	0.2	0.2	0.00%	-0.7	-79%	0.0	-7%
1.A.4.a. Commercial/Institutional: Solid Fuels (CH_4)	1 641.1	5.9	7.2	0.00%	-1 633.9	-100%	1.3	22%
1.A.4.a. Commercial/Institutional: Solid Fuels (N_2O)	129.5	8.1	9.0	0.00%	-120.5	-93%	0.9	11%
1.A.4.b. Residential: Biomass (N_2O)	1 516.0	2 407.2	2 306.1	0.09%	790.1	52%	-101.1	-4%
1.A.4.b. Residential: Gaseous Fuels (CH_4)	589.5	576.4	509.5	0.02%	-80.0	-14%	-66.9	-12%
1.A.4.b. Residential: Gaseous Fuels (N_2O)	224.1	292.5	259.9	0.01%	35.8	16%	-32.6	-11%
1.A.4.b. Residential: Liquid Fuels (CH_4)	352.6	144.3	133.8	0.01%	-218.8	-62%	-10.5	-7%
1.A.4.b. Residential: Liquid Fuels (N_2O)	532.1	180.2	167.4	0.01%	-364.7	-69%	-12.9	-7%
1.A.4.b. Residential: Other Fuels (CH_4)	0.0	0.4	0.3	0.00%	0.3	100%	-0.2	-40%

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.4.b. Residential: Other Fuels (CO_2)	0.0	12.7	8.7	0.00%	8.7	100%	-4.0	-32%
1.A.4.b. Residential: Other Fuels (N_2O)	0.0	0.1	0.0	0.00%	0.0	100%	0.0	-35%
1.A.4.b. Residential: Peat (CH_4)	288.1	61.4	51.9	0.00%	-236.2	-82%	-9.5	-15%
1.A.4.b. Residential: Peat (CO_2)	3 585.1	765.4	643.5	0.02%	-2 941.5	-82%	-121.9	-16%
1.A.4.b. Residential: Peat (N_2O)	13.8	2.9	2.3	0.00%	-11.5	-83%	-0.5	-18%
1.A.4.b. Residential: Solid Fuels (N_2O)	785.8	107.5	101.5	0.00%	-684.3	-87%	-6.0	-6%
1.A.4.c. Agriculture/Forestry/Fishing: Biomass (CH_4)	110.9	630.8	587.0	0.02%	476.1	429%	-43.8	-7%
1.A.4.c. Agriculture/Forestry/Fishing: Biomass (N_2O)	20.6	153.0	156.7	0.01%	136.1	661%	3.7	2%
1.A.4.c. Agriculture/Forestry/Fishing: Gaseous Fuels (CH_4)	86.4	1 047.7	1 180.2	0.04%	1 093.8	1266%	132.5	13%
1.A.4.c. Agriculture/Forestry/Fishing: Gaseous Fuels (N_2O)	7.5	9.4	9.3	0.00%	1.8	24%	-0.1	-1%
1.A.4.c. Agriculture/Forestry/Fishing: Liquid Fuels (CH_4)	221.3	100.3	96.6	0.00%	-124.6	-56%	-3.7	-4%
1.A.4.c. Agriculture/Forestry/Fishing: Liquid Fuels (N_2O)	2 947.1	2 833.8	2 890.5	0.11%	-56.6	-2%	56.8	2%
1.A.4.c. Agriculture/Forestry/Fishing: Other Fuels (CH_4)	0.0	0.2	0.1	0.00%	0.1	100%	-0.1	-42%
1.A.4.c. Agriculture/Forestry/Fishing: Other Fuels (CO_2)	0.0	63.3	66.1	0.00%	66.1	100%	2.9	5%
1.A.4.c. Agriculture/Forestry/Fishing: Other Fuels (N_2O)	0.0	3.0	3.3	0.00%	3.3	100%	0.3	11%
1.A.4.c. Agriculture/Forestry/Fishing: Peat (CH_4)	1.0	8.1	6.9	0.00%	5.9	618%	-1.2	-15%
1.A.4.c. Agriculture/Forestry/Fishing: Peat (CO_2)	45.0	196.1	182.7	0.01%	137.8	306%	-13.4	-7%
1.A.4.c. Agriculture/Forestry/Fishing: Peat (N_2O)	0.4	1.5	1.4	0.00%	1.0	221%	0.0	-2%
1.A.4.c. Agriculture/Forestry/Fishing: Solid Fuels (CH_4)	743.3	185.0	165.0	0.01%	-578.3	-78%	-20.0	-11%
1.A.4.c. Agriculture/Forestry/Fishing: Solid Fuels (N_2O)	33.8	8.9	7.9	0.00%	-25.9	-77%	-1.0	-11%
1.A.5.a. Stationary: Biomass (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Biomass (N_2O)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Gaseous Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Gaseous Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Gaseous Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Liquid Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Liquid Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Liquid Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Other Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Other Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Other Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Peat (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Peat (CO_2)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Peat (N_2O)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Solid Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.a. Stationary: Solid Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Biomass (CH_4)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Biomass (N_2O)	-	-	-	-	-	-	-	-

	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 1. Energy in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
1.A.5.b. Mobile: Gaseous Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Gaseous Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Gaseous Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Liquid Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Liquid Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Other Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Other Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Other Fuels (N_2O)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Solid Fuels (CH_4)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Solid Fuels (CO_2)	-	-	-	-	-	-	-	-
1.A.5.b. Mobile: Solid Fuels (N_2O)	-	-	-	-	-	-	-	-
1.B.1.a. Coal mining and handling: no classification (CO_2)	664.9	165.5	149.2	0.01%	-515.8	-78%	-16.3	-10%
1.B.1.a. Coal mining and handling: no classification (N_2O)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
1.B.1.b. Fuel transformation: no classification (CH_4)	274.5	65.5	64.4	0.00%	-210.1	-77%	-1.2	-2%
1.B.1.b. Fuel transformation: no classification (CO_2)	6 133.8	2 973.2	2 800.6	0.11%	-3 333.2	-54%	-172.6	-6%
1.B.1.b. Fuel transformation: no classification (N_2O)	0.1	0.1	0.1	0.00%	0.1	112%	0.0	6%
1.B.1.c. Other: no classification (CH_4)	-	-	-	-	-	-	-	-
1.B.1.c. Other: no classification (CO_2)	-	-	-	-	-	-	-	-
1.B.1.c. Other: no classification (N_2O)	-	-	-	-	-	-	-	-
1.B.2.a. Oil: no classification (N_2O)	22.3	5.3	5.5	0.00%	-16.8	-75%	0.1	2%
1.B.2.b. Natural gas: no classification (CO_2)	2 385.4	911.1	747.7	0.03%	-1 637.8	-69%	-163.4	-18%
1.B.2.c. Venting and flaring: no classification (CH_4)	6 665.3	2 670.6	2 613.5	0.10%	-4 051.8	-61%	-57.1	-2%
1.B.2.c. Venting and flaring: no classification (CO_2)	4 724.2	2 520.2	2 434.8	0.09%	-2 289.4	-48%	-85.4	-3%
1.B.2.c. Venting and flaring: no classification (N_2O)	14.2	8.2	8.4	0.00%	-5.9	-41%	0.2	2%
1.B.2.d. Other: no classification (CH_4)	-	-	-	-	-	-	-	-
1.B.2.d. Other: no classification (CO_2)	-	-	-	-	-	-	-	-
1.B.2.d. Other: no classification (N_2O)	-	-	-	-	-	-	-	-
1.C. CO_2 transport and storage: Fuels (CO_2)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%

3.7 Methodological issues and uncertainties

The previous section presented for each EU key category in CRT Sector 1 an overview of the Member States' contributions to the key categories in terms of level and trend, and - for each key category - summary information on methodologies and emission factors using the notations T1, T2, D, etc. No detailed explanations of Member States methods used is included for 1A because for most categories the method used is simply multiplying activity data by (country-specific) emissions factors. However, note that Annex III of the EU NID also includes for each Member State an overview of methods amd emission factors used including a short explantation, where relevant. In addition the Member States' national inventory reports include more detailed information on national methods and circumstances.

Table 3.116 shows the total EU uncertainty estimates for the sector 'Energy' (excluding 1A3 'Transport' and 1B 'Fugitive') for the relevant gases for each source category. For those emissions for which no split by source category was available, uncertainty estimates were made for stationary combustion as a whole. The highest level uncertainty was estimated for CH_4 from 1A1c and the lowest for CO_2 from 1A2e. With regard to trend CH_4 from 1A1a shows the highest uncertainty estimates, CO_2 from 1A2a the lowest. The results of this year's uncertainty analysis are very similar to the results in 2024. For a description of the Tier 1 uncertainty analysis carried out for the EU see Chapter 1.6.

Table 3.116 Sector 1 Energy (excl. 1A3b and 1B): Uncertainty estimates

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A.1.a Public electricity and heat production	CO_2	589 928	263 166	-55.39%	2.34%	1.15%
1.A.1.a Public electricity and heat production	CH_4	275	2 749	898.84%	52.26%	483.04%
1.A.1.a Public electricity and heat production	N_2O	2 510	1 713	-31.75%	15.87%	6.38%
1.A.1.b Petroleum refining	CO_2	59 828	48 861	-18.33%	5.12%	1.02%
1.A.1.b Petroleum refining	CH_4	23	19	-17.65%	15.47%	5.45%
1.A.1.b Petroleum refining	N_2O	206	73	-64.77%	23.32%	23.99%
1.A.1.c Manufacture of solid fuels and other energy industries	CO_2	73 283	15 188	-79.28%	7.59%	4.56%
1.A.1.c Manufacture of solid fuels and other energy industries	CH_4	114	121	6.35%	108.39%	10.85%
1.A.1.c Manufacture of solid fuels and other energy industries	N_2O	590	115	-80.58%	23.35%	19.54%
1.A.2.a Iron and Steel	CO_2	54 013	38 351	-29.00%	5.45%	0.55%
1.A.2.a Iron and Steel	CH_4	86	67	-22.55%	24.95%	5.39%
1.A.2.a Iron and Steel	N_2O	206	96	-53.36%	33.79%	42.98%
1.A.2.b Non-ferrous Metals	CO_2	2 352	1 220	-48.14%	2.31%	5.57%
1.A.2.b Non-ferrous Metals	CH_4	2	1	-59.49%	33.82%	30.24%
1.A.2.b Non-ferrous Metals	N_2O	15	3	-82.86%	52.84%	48.15%
1.A.2.c Chemicals	CO_2	25 146	6 495	-74.17%	1.83%	1.96%
1.A.2.c Chemicals	CH_4	20	25	24.87%	48.00%	48.79%
1.A.2.c Chemicals	N_2O	32	31	-2.63%	84.24%	39.43%
1.A.2.d Pulp, Paper and Print	CO_2	5 330	1 985	-62.76%	3.00%	2.45%
1.A.2.d Pulp, Paper and Print	CH_4	22	26	17.80%	25.33%	6.59%
1.A.2.d Pulp, Paper and Print	N_2O	83	100	20.12%	32.69%	11.23%
1.A.2.e Food Processing, Beverages and Tobacco	CO_2	8 594	4 537	-47.21%	1.73%	1.53%
1.A.2.e Food Processing, Beverages and Tobacco	CH_4	13	17	33.40%	57.74%	58.78%
1.A.2.e Food Processing, Beverages and Tobacco	N_2O	35	11	-67.98%	61.50%	30.14%
1.A.2.f Non-metallic minerals	CO_2	29 850	18 725	-37.27%	2.60%	1.47%
1.A.2.f Non-metallic minerals	CH_4	77	49	-36.72%	25.68%	16.31%
1.A.2.f Non-metallic minerals	N_2O	215	153	-29.01%	30.57%	13.37%
1.A.2.g Other	CO_2	164 967	72 268	-56.19%	3.15%	1.51%
1.A.2.g Other	CH_4	211	245	15.96%	25.12%	9.39%
1.A.2.g Other	N_2O	1 043	604	-42.10%	27.37%	14.60%
1.A.4.a Commercial/Institutional	CO_2	86 518	37 898	-56.20%	6.21%	4.56%
1.A.4.a Commercial/Institutional	CH_4	1 786	271	-84.85%	46.46%	91.08%
1.A.4.a Commercial/Institutional	N_2O	236	119	-49.73%	80.58%	22.30%
1.A.4.b Residential	CO_2	202 773	115 856	-42.86%	5.94%	2.33%
1.A.4.b Residential	CH_4	5 075	2 984	-41.19%	51.43%	52.22%
1.A.4.b Residential	N_2O	966	596	-38.33%	61.03%	40.07%

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A.4.c Agriculture/forestry/fishing	CO_2	33 549	22 849	-31.89%	6.12%	1.67%
1.A.4.c Agriculture/forestry/fishing	CH_4	502	1 540	207.12%	41.27%	97.78%
1.A.4.c Agriculture/forestry/fishing	N_2O	249	351	40.87%	63.01%	26.99%
1.A.5 Other	CO_2	21 616	6 354	-70.60%	3.31%	2.34%
1.A.5 Other	CH_4	335	13	-96.21%	40.70%	42.14%
1.A.5 Other	N_2O	174	42	-75.70%	91.20%	32.59%
1.A (where no subsector data were submitted)	*all*	23 344	27 074	15.98%	2.46%	2.26%
1.A.1 (where no subsector data were submitted)	*all*	714 362	363 786	-49.08%	11.72%	12.53%
1.A.2 (where no subsector data were submitted)	*all*	422 536	215 199	-49.07%	7.23%	3.55%
1.A.3 (where no subsector data were submitted)	*all*	122 944	177 354	44.26%	4.00%	2.28%
1.A.4 (where no subsector data were submitted)	*all*	381 097	261 203	-31.46%	5.39%	2.50%
1.A.5 (where no subsector data were submitted)	*all*	0	0	0.00%	0.00%	0.00%
Total - 1.A (where no subsector data were submitted)	**all**	**23 344**	**27 074**	**15.98%**	**2.46%**	**2.26%**
Total - 1.A.1	**all**	**1 441 121**	**695 791**	**-51.72%**	**6.21%**	**6.23%**
Total - 1.A.2	**all**	**714 849**	**360 205**	**-49.61%**	**4.41%**	**2.13%**
Total - 1.A.3	**all**	**658 961**	**776 620**	**17.86%**	**2.32%**	**0.63%**
Total - 1.A.4	**all**	**712 751**	**443 667**	**-37.75%**	**3.61%**	**1.65%**
Total - 1.A.5	**all**	**22 125**	**6 409**	**-71.03%**	**3.34%**	**2.39%**
Total - 1.A	**all**	**3 573 150**	**2 309 766**	**-35.36%**	**2.30%**	**2.57%**

Note: Emissions are in kt CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

Table 3.117 the total EU uncertainty estimates for the sector 1.B 'Fugitive emissions' and the uncertainty estimates for the relevant gases for each source category. The highest level uncertainties were estimated for N_2O from 1B2 and the lowest for CO_2 from 1B1; the highest trend uncertainties were estimated for N_2O from 1B1, the lowest for CO_2 from 1B1. Uncertainties analysis show very similar results as in 2024.

Table 3.117 1B Fugitive Emissions: Uncertainty estimates

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.B.1 Solid Fuels	CO_2	6 788	2 918	-57.01%	15.04%	8.25%
1.B.1 Solid Fuels	CH_4	79 372	21 774	-72.57%	76.91%	15.68%
1.B.1 Solid Fuels	N_2O	0	0	106.38%	67.55%	61.93%
1.B.2. Oil and Natural Gas and other emissions from energy production	CO_2	12 378	12 172	-1.66%	72.72%	31.32%
1.B.2. Oil and Natural Gas and other emissions from energy production	CH_4	50 665	12 179	-75.96%	53.83%	18.87%
1.B.2. Oil and Natural Gas and other emissions from energy production	N_2O	35	13	-63.12%	105.65%	50.15%
1.B (werhe no subsector data were submitted)	all	17 664	5 132	-70.95%	42.11%	38.68%
Total - 1.B	**all**	**166 902**	**54 189**	**-68%**	**42%**	**11%**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

Table 3.118 shows the total EU uncertainty estimates for the sector 1A3 'Transport' and the uncertainty estimates for the relevant gases for each source category. The highest level uncertainty was estimated for N_2O from 1A3d and the lowest for CO_2 from 1A3b. With regard to trend N_2O from 1A3e shows the highest uncertainty estimates, CO_2 from 1A3b the lowest. The results of this year's uncertainty analysis are very similar to the results in 2024.

Table 3.118 1A3 Transport: Uncertainty estimates for EU

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A.3.a Domestic aviation	CO_2	9 375	10 135	8.10%	9.05%	3.46%
1.A.3.a Domestic aviation	CH_4	8	4	-54.34%	92.11%	34.06%
1.A.3.a Domestic aviation	N_2O	73	59	-19.79%	183.71%	32.74%
1.A.3.b Road transport	CO_2	487 162	567 313	16.45%	2.86%	0.46%
1.A.3.b Road transport	CH_4	4 601	731	-84.12%	24.92%	6.86%
1.A.3.b Road transport	N_2O	3 856	5 546	43.81%	31.00%	8.16%
1.A.3.c Railways	CO_2	9 355	2 746	-70.65%	4.87%	2.62%
1.A.3.c Railways	CH_4	32	5	-85.78%	72.77%	21.07%
1.A.3.c Railways	N_2O	398	110	-72.22%	82.80%	38.63%
1.A.3.d Domestic navigation	CO_2	15 250	9 459	-37.97%	29.95%	13.46%
1.A.3.d Domestic navigation	CH_4	39	55	41.29%	55.78%	19.98%
1.A.3.d Domestic navigation	N_2O	181	160	-11.40%	231.22%	12.34%
1.A.3.e Other transportation	CO_2	5 627	2 914	-48.21%	4.52%	1.91%
1.A.3.e Other transportation	CH_4	13	7	-43.84%	57.05%	15.33%
1.A.3.e Other transportation	N_2O	47	22	-54.07%	75.96%	53.05%
1.A.3 (where no subsector data were submitted)	*all*	122 944	177 354	44.26%	4.00%	2.28%
Total - 1.A.3	**all**	**658 961**	**776 620**	**17.86%**	**2.32%**	**0.63%**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

3.8 Sector-specific quality assurance and quality control

There are several activities for improving the quality of GHG emissions from energy: Before and during the compilation of the EU GHG inventory, several checks are made of the Member States data in particular for time series consistency of emissions and implied emission factors, comparisons of implied emission factors across Member States and checks of internal consistency. Table 3.119 summarizes the main checks carried out on Member States' submissions.

Table 3.119 Quality checks carried out on Member States' submissions

Issue	Check
Completeness	Check categories where Member States report the notation key NE for potential underestimations Check categories where Member States report a notation key and 20 or more Member States report emissions and assess if there are potential over- or underestimates All years, but focus on last reporting year and also 1990 Focus on EU key categories
Time series of emissions	Check time series consistency of Member States' emission estimates for potential over- and underestimates: All years, but focus on last reporting year and also 1990 Focus on EU key categories

Issue	Check
Time series of IEFs	Check time series consistency of Member States' IEFs for potential over- and underestimates: All years, but focus on last reporting year and also 1990 Focus on EU key categories
Outlier checks of IEFs	Compare IEFs across Member States and assess if there are potential over- and underestimations of emissions Compare Member States' IEFs with (range of) default EF from 2006 IPCC GL All years, but focus on last reporting year and also 1990 Focus on EU key categories
Recalculations	Check categories where Member States provide recalculations and focus on those of more than 0.05% of national total emissions for each main gas and assess if there are potential over- or underestimates. Also explanations for recalculations were checked either from MS Annexes or NID. All years, but focus on last reporting year and also 1990 Focus on EU key categories
Follow-up from 2023	Check if issues that were classified as "Unresolved" or "Partly resolved" in 2024 have been resolved by Member States in 2025.
Implementation of UNFCCC recommendations	Check if recommendations from the latest UNFCCC review reports have been implemented by Member States.
Reporting of non-energy use of fossil fuels	Check plausibility of reporting in CRF table 1A(d) as compares reporting in CRF table 1A(b), 1A(c) and the IPPU sector.

After the preparation of the EU GHG inventory, the EU carries out internal reviews and or capacity building activities in order to improve the GHG inventory estimates. In 2005, an EU internal review was carried out for the first time. Since 2012 the EU internal reviews are carried out in the context of the ESD / ESR reviews.

- In 2012 a comprehensive review was carried out for all sectors and all EU Member States in order to fix the base year for the 2020 targets under the EU Effort Sharing Decision (ESD review 2012). This review also covered the energy sector of the MS GHG inventories (peer review).
- In 2015, a few Member States volunteered to be reviewed under step 2 of the ESD trial review for the sector energy.
- In 2016, again a comprehensive review was carried out for all sectors and all EU Member States with a focus on the years 2005, 2008-2010, 2013 and 2014 in order to track progress of the EU Member States under the EU Effort Sharing Decision (ESD review 2016).
- In 2017-2019, annual reviews were carried out for all significant issues identified during the initial checks phase with a focus on the years 2015-2017 in order to track progress of the EU Member States under the EU Effort Sharing Decision.
- In 2020, again a comprehensive review was carried out for all sectors and all EU Member States with a focus on the years 2005, 2016-2018 in order to track progress of the EU Member States under the EU Effort Sharing Decision and in order to fix the base year for the 2030 targets under the EU Effort Sharing Regulation (ESD review 2020).
- In 2021 an annual review was carried out for all significant issues identified during the initial checks phase with a focus on the year 2019 in order to track progress of the EU Member States under the EU Effort Sharing Decision.
- In 2022 an annual review is carried out for all significant issues identified during the initial checks phase with a focus on the year 2020 in order to track progress of the EU Member States under the EU Effort Sharing Decision.

- In 2025, a comprehensive review will be carried out for all sectors and all EU Member States with a focus on the years 2021-2023 in order to determine the annual emission allocations for the years 2026 to 2030 under the Effort Sharing Regulation (ESR) for all EU Member States (ESD review 2025)

In addition, every year after the ESD review capacity building activities are organized. In 2022 the energy-related webinar had 82 participants from 26 countries. Main issues discussed at the webinar were:

- Difference between CRF and Eurostat AD for subcategory 1.A.4.b
- Use of NCVs and CO_2 EFs from EU ETS reports to non-industrial sectors (1.A.4)
- High CO_2 IEF of other fuels (MSW)
- Adjustment of energy balance data to reflect EU- ETS data

In 2023 and 2024, capacity building activities were organised bilaterally with interested countries.

EU ETS data

Since the inventory 2005 plant-specific data is available from the EU Emission Trading Scheme (EU ETS). This information has been used by EU Member States for quality checks and as input for calculating total CO_2 emissions for the sectors Energy and Industrial Processes in this report (see Section 1.4.2). During the ESR review and during the initial checks consistency checks have been carried out between EU ETS data and the inventory estimates.

Eurostat energy data

During the initial checks carried out before the compilation of the EU GHG inventory Eurostat energy data is used for cross checking the sectoral and reference approach of the MS submissions. This cross check between the European energy reporting system and the EU GHG inventory system is an important QA/QC element of the EU GHG inventory compilation.

The quality of the EU GHG inventory is directly affected by the quality of Member States and EU energy statistics systems. EU energy statistics are collected by Eurostat on the basis of the EU energy statistics regulation[25]. The energy statistics regulation was adopted as part of the energy package and establishes a common framework for the production, transmission, evaluation and dissemination of comparable energy statistics in the EU.

This regulation aims at collecting detailed statistical data on energy flows by energy commodity at annual and monthly level. It ensures harmonised and coherent reporting of national energy data, which is indispensable for the assessment of EU energy policies and targets. The content and structure of this regulation reflects the essence of the existing European statistical system, a system that is part of the international energy statistical system, and is in direct link with the national statistical structures (classifications) and methodologies. It also has concrete links to other statistical domains, such as economic, environment, trade and business statistics. These links provide an additional dimension in safeguarding data quality assurance.

The European energy statistics system and the quality of the EU inventory are directly affected by this regulation that:

- ensures a stable and institutional basis for energy statistics in the EU
- guarantees long-term availability of energy data for EU policies
- reinforces available resources for the production of the basic energy statistics at national level

The energy statistics regulation helps improving the QA/QC of the EU inventory as it:

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[25] REGULATION (EC) No 1099/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2008 on energy statistics as amended by Commission Regulation (EU) No 147/2013 of 13 February 2013.

- makes available more detailed energy statistics by fuel
- allows the estimation of CO_2 emissions from energy with the reference and sectoral approach
- assures the quality of the underlying energy statistics
- improves timeliness of energy statistics
- provides a formal legal framework assuring consistency between national and Eurostat data

Moreover, Article 6, paragraph 2 stipulates that:

'Every reasonable effort shall be undertaken to ensure coherence between energy data declared in the energy statistics regulation, and data declared in accordance with Commission Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol'.

In addition, Annex V of the Governance Regulation in conjunction with Article 17 of the Commission Implementing Regulation 2020/1208 requires Member States to report to the European Commission textual information on the comparison between the reference approach calculated on the basis of the data included in the greenhouse gas inventory and the reference approach calculated on the basis of the data reported pursuant to the Energy Statistics Regulation. Member States with differences of more than +/- 2% in the total national apparent fossil fuel consumption have to provide quantitative information and explanations for the year X-2 in accordance with the tabular format set out in Annex XIV of the Commission Implementing Regulation.

Eurocontrol data

Since 2010 there have been framework contracts in place between the European Commission and Eurocontrol, the European Organization for the Safety of Air Navigation, related to the improvement of GHG and air pollutant emission inventories submitted by the EU Member States to the UNFCCC and UNECE. The aim has been to assist the MS in improving their annual emission inventories, i.e. by providing better estimates of fuel split in domestic/international aviation using real flight data from Eurocontrol. In the framework of this cooperation, the European Environment Agency, with its ETC CM (European Topic Centre on Climate Change Mitigation) work programs, compares the MS inventory submissions with Eurocontrol data and produces a report where the outcome of these comparisons is presented and discussed.

The most recent data provided by Eurocontrol was in Aug.-Sep. 2024, following the information that has been given in previous years related to fuel consumption and emissions for CO_2, CH_4, N_2O and other pollutants for domestic and international aviation, covering the period from 2005 to 2023. The main update of the Aug.-Sep. 2024 version of data was the recalculations for years 2018-2023. Eurocontrol uses a bottom-up modelling approach with the Advanced Emissions Model (AEM). This is a Tier 3b methodology based on information of flight plan and trajectories. Flight plan data is only available for flights under Instrumental Flight Rules (IFR). Flights under Visual Flight Rules (VFR) are not included in the dataset of Eurocontrol.

The latest version of the report with the **comparison of MS inventories (15 Jan. 2025 submission)** with Eurocontrol data for years 2005-2023 has been prepared and delivered early March 2025. Main checks included domestic and international fuel consumption for jet kerosene and aviation gasoline; in addition, domestic share and implied emission factor (IEF) CO_2, CH_4, and N_2O for both jet kerosene and aviation gasoline. A general observation that can be made from the comparisons performed in the framework of this report is that in some cases the Eurocontrol values are slightly higher than the GHG inventories reported by the Member States. Higher differences are observed only in a few cases, i.e. for individual countries and for a specific fuel/data category. Some observations specifically for EU-27 are summarised below:

- Domestic kerosene Eurocontrol values are higher than MS GHG inventories for years 2005-2017 (differences from 27% to 36%). For years 2018-2022, small differences are observed (from 0% to 3%). A higher difference (13%) is observed in 2023, due to unavailability of Germany inventory submission (at the time of preparing the relevant report).
- Domestic aviation gasoline Eurocontrol values are very low, i.e. slightly higher than 0 for all years; hence, there are big differences with MS inventories (from -92% to -85%).
- International kerosene Eurocontrol values are higher than MS GHG inventories for years 2005-2017 (differences from 8% to 15%). For years 2018-2022, small differences are observed (from -5% to -2%) and Eurocontrol values are in general lower than MS GHG inventories. A higher difference (25%) is observed in 2023, due to unavailability of Germany inventory submission.
- Eurocontrol values of domestic share in total (i.e. domestic + international) kerosene consumption are higher than the values from MS GHG inventories for all years (differences from 3% to 21%), except for 2023, for which Eurocontrol value is lower than MS GHG inventory value (difference -9%).
- Total kerosene Eurocontrol values are higher than the MS GHG inventories for years 2005-2017 (differences from 11% to 17%). For years 2018-2022, small differences are observed (from -5% to -2%) and Eurocontrol values are in general lower than MS GHG inventories. A higher difference (24%) is observed in 2023, due to unavailability of Germany inventory submission.

Methodological differences: There are possibly methodological differences between Eurocontrol and MS inventories. For example, in domestic aviation gasoline, the Eurocontrol methodology is based exclusively on flights under IFR; small aircrafts, which mostly use aviation gasoline, usually fly under VFR and, therefore, are not sufficiently covered. Another difference is that the Eurocontrol values strictly refer to aviation activities, i.e. flights, and the fuel consumed in these activities is modelled for individual trajectories. While in the MS inventories, the fuel consumption has to be adapted to the national energy balances.

Military aviation: This source is strictly excluded from Eurocontrol and, as clarified in the CRT tables, domestic aviation should not include emissions from military aviation. The emissions from military mobile sources should be reported under category 1.A.5.b (Other mobile military use).

Domestic share: Domestic share in total (i.e. domestic + international) fuel consumption is an important indicator for the aviation sector. Some MS mention in their NIRs that their national energy balances provide separately the fuel sold for domestic and international flights or that the fuel consumption at individual airports is defined as being used for domestic or international flights. In any case, Eurostat and Eurocontrol (which has detailed information for the origin/destination pairs of most flights) can be used to derive this indicator.

Tier method: A possible inconsistency may exist in the definition of Tier method reported by countries in their NIDs. For example, Tier 1 from the IPCC guidelines considers only the use of fuel from national energy statistics, whereas in the EMEP/EEA Guidebook the Tier 1 method already separates between LTO and cruise phase. It is proposed to report information based on the IPCC guidelines in order to allow for a consistent overview of applied methodologies. Specifically:

- Tier 1: Fuel consumption data split by domestic and international aviation.
- Tier 2: LTO data from number of flights (2a) or from flights by aircraft type (2b).
- Tier 3: LTO data for individual aircrafts and data on the origin/destination pairs of flights (3a) and on air traffic movements (3b).

Table 3.120 provides an overview of how the Eurocontrol data has been used by MS.

Table 3.120 Use of Eurocontrol data by Member States

	Use of Eurocontrol data for kerosene consumption				
	For comparison / verification	For planned improvements	Indirect use	Direct use	How has the time series consistency been ensured?
Austria	-	-	-	-	-
Belgium			Data per airport, to make distribution of emissions in the regions possible	In Flemish region for international flights. In Wallonia, for N_2O and CH_4	
Bulgaria			LTO per aircraft type for years 1996-2023		
Croatia	-	-	-	-	-
Cyprus				For domestic and international flights	Trend of domestic share from Eurocontrol data has been applied to years 2005-2023
Czechia				Emissions calculated with Eurocontrol IEFs	
Denmark			List of aircraft types provided by Eurocontrol		
Estonia	-	-	-	-	-
Finland				For domestic flights from 2005 onwards	Own model (ILMI) has been used for years before 2005 and partly until 2008; since 2010 the model was not updated; no specific adaptation
France	Not mentioned, numbers match very closely				
Germany	Yes				
Greece				For domestic and international flights	Emissions for 1990-2005 have been recalculated taking into account only international aviation fuel consumption and by applying Tier 1 methodology
Hungary				For domestic flights	Fuel use (and, consequently, emissions) for years before 2005 has been adapted with built-in extrapolation procedures; same share of kerosene use from Eurocontrol 2005-2015 for domestic flights has been applied for years 1985-2004
Ireland				Fuel consumption based on origin and destination data for domestic air travel provided by Eurocontrol (2005-2023)	
Italy	Yes			Domestic	Emissions recalculated based on Eurocontrol; linear interpolation between 1999 (the year of Tier 3) and 2005 for fuel consumption and emission factors
Latvia	Yes				
Lithuania					
Luxembourg	-	-	-	-	-
Malta				Domestic aviation (2005-2023)	
Netherlands	-	-	-	-	-
Poland				For share of domestic flights	Due to lack of Eurocontrol data for years prior to 2005, the share of domestic use for years

	Use of Eurocontrol data for kerosene consumption				
	For comparison / verification	For planned improvements	Indirect use	Direct use	How has the time series consistency been ensured?
					1988-2004 was assumed as a 5-years average from Eurocontrol data for years 2005-2009
Portugal					
Romania	-	-	-	-	-
Slovakia				Eurocontrol data on the number of flights, fuel consumption and domestic share was used	For years 1990-2004, summary information from Eurocontrol database was used (emission factors and domestic share)
Slovenia				For domestic flights, since 2017 data on fuel consumption from Eurocontrol	Only a small amount of domestic flights has been recorded by Eurocontrol; no adaptation for years 1990-2004
Spain				For domestic and international flights	An adaptation model has been applied to link results based on national statistics with Eurocontrol
Sweden	-	-	-	-	-

3.9 Sector-specific recalculations

Recalculations are described in chapter add reference to recalculation chapter , including the explanations for significant changes (>1000 kt CO_2eq) in categories.

3.10 Sector-specific improvements

Information across sectors has been streamlined to provide a harmonised approach across the whole NID. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

Improvements planned for the next reporting are continuing the efforts to ensure consistency between CRT/JSON files and NID, and the provision of sufficient information to meet transparency requirements.

4 INDUSTRIAL PROCESSES AND PRODUCT USE (CRT SECTOR 2)

This chapter starts with an overview of emission trends in CRT Sector 2 Industrial Processes and Product Use. This sector covers the following sub-sectors:

- Mineral Industry (CRT Source Category 2.A)
- Chemical Industry (CRT Source Category 2.B)
- Metal Industry (CRT Source Category 2.C)
- Non-Energy Products from Fuels and Solvent Use (CRT Source Category 2.D)
- Electronics Industry (CRT Source Category 2.E)
- Product Uses as Substitutes for Ozone Depleting Substances (CRT Source Category 2.F)
- Other Product Manufacture and Use (CRT Source Category 2.G)
- Other (CRT Source Category 2.H)

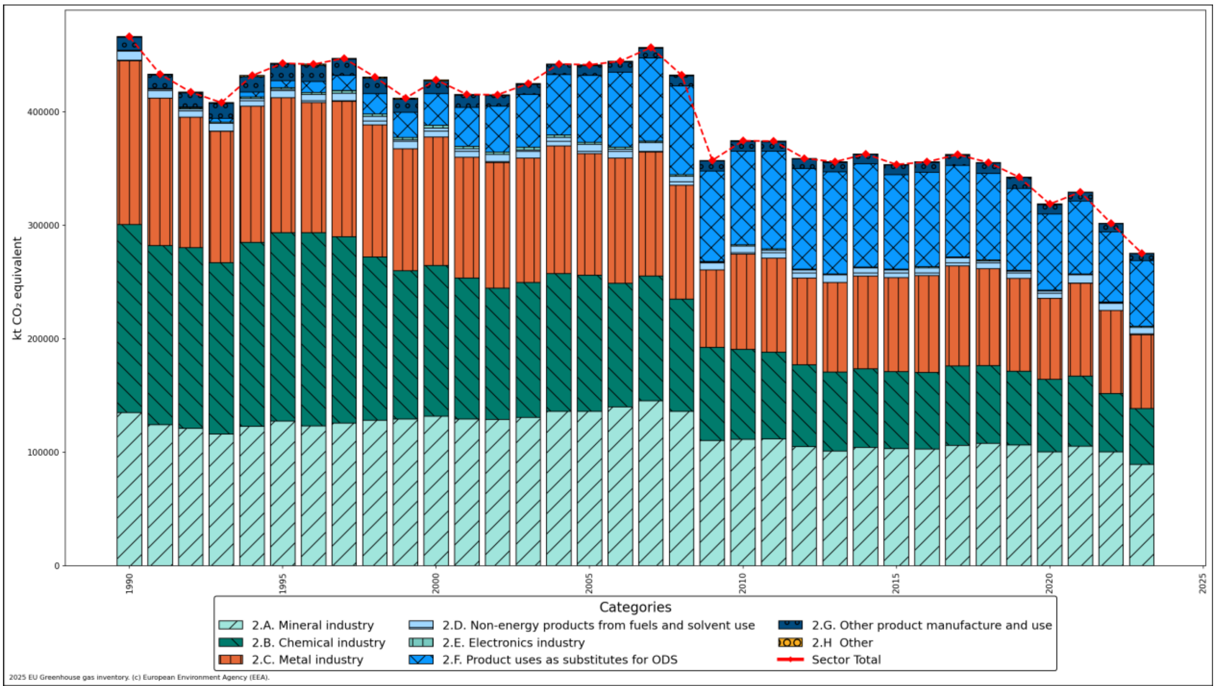
For each Union key category, overview tables are presented including the Member States' contributions to the key categories in terms of level and trend, and information on methodologies and emission factors.

4.1 Overview of sector

CRT Sector 2 Industrial Processes and Product Use is the third largest sector contributing 8.8 % to total net EU GHG emissions in 2023. The most important GHGs from this sector are CO_2 (6.5 % of total net GHG emissions), HFCs (1.8 %) and N_2O (0.2 %).

The emissions from the IPPU sector decreased by 41 % from 466 Mt CO_2eq in 1990 to 275 Mt CO_2eq in 2023 (*Figure 4.1*). In 2023, the emissions decreased by 9 % compared to 2022. The largest annual decrease in emissions was observed between 2008 and 2009, driven by reductions in cement production and a significant drop in the iron and steel production as a consequence of the economic crisis.

Figure 4.1: CRF Sector 2 Industrial Processes and Product Use: EU GHG emissions for 1990–2023 in kt CO_2 equivalents



The key categories in this sector are:

- 2.A.1 Cement Production: no classification (CO_2)
- 2.A.2 Lime Production: no classification (CO_2)
- 2.A.4 Other Process Uses of Carbonates: no classification (CO_2)
- 2.B.1 Ammonia Production: no classification (CO_2)
- 2.B.2 Nitric Acid Production: no classification (N_2O)
- 2.B.3 Adipic Acid Production: no classification (N_2O)
- 2.B.8 Petrochemical and Carbon Black Production: no classification (CO_2)
- 2.B.9 Fluorochemical Production: no classification (Unspecified mix of HFCs and PFCs)
- 2.B.10 Other chemical industry: no classification (CO_2)
- 2.C.1 Iron and Steel Production: no classification (CO_2)
- 2.C.3 Aluminium Production: no classification (PFCs)
- 2.F.1 Refrigeration and Air conditioning: no classification (HFCs)

4.2 Overview of trends in the IPPU sector

The IPPU sector showed an overall decrease in GHG emissions, with major declines ocurring in 2009 and in the years following 2018. Among the IPPU subsectors, the chemical industry showed the largest emission decrease, with a reduction of 69 % between 1990 and 2023. Emissions from subsector 2.E – product uses as substitutes for ODS – became relevant after 1990 and started decreasing in recent years.

In this section we analyze the contribution of different source categories to the overall trend of emissions from the IPPU sector in the EU. Table 4.1 shows the main categories on an aggregated level, visualising that CO_2 emissions from 2A Mineral Industry had the highest share in 2023, but decreased like almost all other categories compared to 1990. The only category showing an increase is HFC emissions from refrigeration and air conditioning, which played a very minor role in 1990.

Table 4.1 CRF Sector 2 Industrial processes and Product Use: Emissions in CO_2 equivalents (Mt) for 1990 and 2023, ,absolute and relative change of GHG emissions and share of key categories 1990–2023

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
2.F.1 - Refrigeration and Air conditioning - HFCs	5	51247	51	1098959%	19%
2.D - Non-energy Products from Fuels and Solvent Use - CO2	8015	6230	-2	-22%	2%
2.B - Chemical Industry - CO2	58209	43208	-15	-26%	16%
All other IPPU categories	56276	14929	-41	-73%	6%
2.A - Mineral Industry - CO2	134074	88414	-46	-34%	33%
2.C - Metal Industry - CO2	114930	58210	-57	-49%	22%
2.B - Chemical Industry - N2O	78849	2546	-76	-97%	1%
Total IPPU	**450359**	**264784**	**-186**	**-41%**	**100%**

Note: Colors visualize decreases (green), increases (red) and the share in sectoral total emissions (yellow). "All other IPPU categories" is calculated by subtracting the presented categories from the sector total.

4.3 Source categories and methodological issues

4.3.1 Mineral industry (CRT Source Category 2A)

The mineral industry includes three key categories:

Table 4.2: Key source categories for level and trend analyses and share of MS emissions using higher tier methods for 2A Mineral industry

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
2.A.1. Cement production: no classification (CO_2)	95237	61198	0	L	L	100 %
2.A.2. Lime production: no classification (CO_2)	23924	14275	0	L	L	99.96 %
2.A.4. Other process uses of carbonates: no classification (CO_2)	11068	7877	0	L	L	91.12 %

The mineral industry is dominated by cement production which contributes approx. 69 % of emissions. Cement production emissions occur during the production of clinker, an intermediate component in the cement manufacturing process. The source category 2A2 Lime production accounts for approx. 16 % of mineral industry emissions. CO_2 is emitted during the calcination of the calcium carbonate in limestone or dolomite. The source category 2A4 Other process uses of carbonates accounts for 11 % of the mineral industry emissions and is composed of several sources with independent estimation methods. The remaining 4 % of emissions stem from 2A3 Glass production. All emissions from cement production are estimated using higher tiers. Under categories 2A2 and 2A4, some EU Member States use Tier 1 methods in cases where these are not a key category.

Mineral industry emissions decreased during the 2009 economic crisis. They showed additional, less pronounced decreases as a consequence of reduced economic activities during the COVID-19 pandemic in 2020 and as a result of the energy crisis in 2022-2023. Overall, these emissions have fallen by 34 % since 1990 (Figure **4.2** and Table **4.3**).

Figure 4.2 2A Mineral industry CO_2 emissions

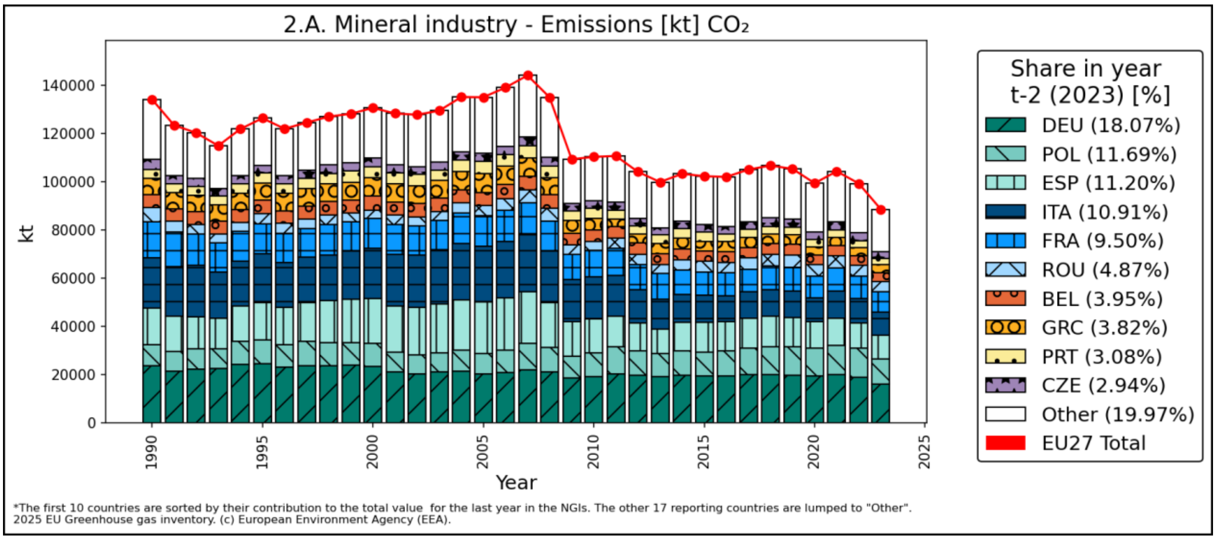


Table 4.3 2A Mineral industry: Member States total GHG and CO_2 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt	
	1990	2023	1990	2023
Austria	3 138	2 561	3 138	2 561
Belgium	5 320	3 489	5 320	3 489
Bulgaria	3 278	1 968	3 278	1 968
Croatia	1 298	1 259	1 298	1 259
Cyprus	717	960	717	960
Czechia	4 082	2 596	4 082	2 596
Denmark	973	1 112	973	1 112
Estonia	603	32	603	32
Finland	1 218	765	1 218	765
France	14 939	8 397	14 939	8 397
Germany	23 522	15 979	23 522	15 979
Greece	6 775	3 381	6 775	3 381
Hungary	2 890	747	2 890	747
Ireland	1 117	1 934	1 117	1 934
Italy	20 720	9 643	20 720	9 643
Latvia	537	537	537	537
Lithuania	2 130	515	2 130	515
Luxembourg	593	245	593	245
Malta	1	0	1	0
Netherlands	1 411	957	1 411	957
Poland	8 855	10 335	8 855	10 335
Portugal	3 672	2 726	3 672	2 726
Romania	6 083	4 305	6 083	4 305
Slovakia	2 714	1 992	2 714	1 992
Slovenia	694	527	694	527
Spain	15 120	9 906	15 120	9 906
Sweden	1 673	1 548	1 673	1 548
EU-27	**134 074**	**88 414**	**134 074**	**88 414**

Abbreviations are explained in the Chapter 'Units and abbreviations'.
For consistency reasons with other sub-sectors, this table shows GHG emissions in CO_2 equivalents and emissions of CO_2 separately. As there are no N_2O or CH_4 emissions in this category, the two sets of columns in this table contain the same numbers.

4.3.1.1 2A1 Cement production

CO_2 emissions from Cement production contributed 2.0 % of total GHG emissions in the EU (without LULUCF) in 2023. In that year, emissions were approx. 9 % below 2022 levels and approx. 36 % below 1990 levels (Figure 4.3 and Table **4.4**). This source is a key category of CO_2 emissions in terms of emissions level and trend.

Figure 4.3 2A1 Cement production: EU CO_2 emissions

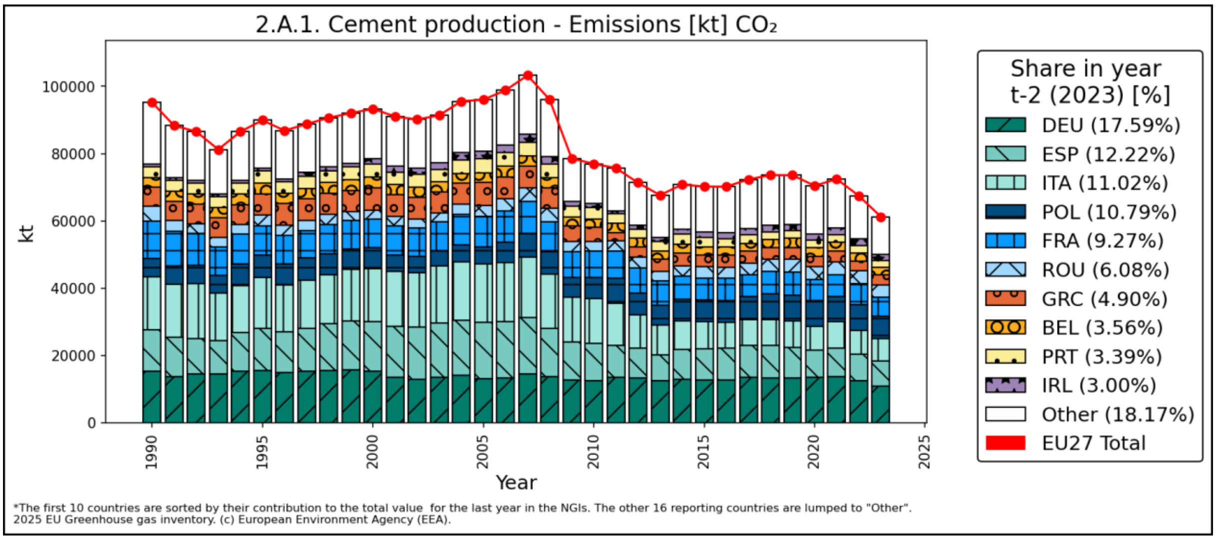


Table 4.4 2A1 Cement production: Member States' contributions to CO_2 emissions

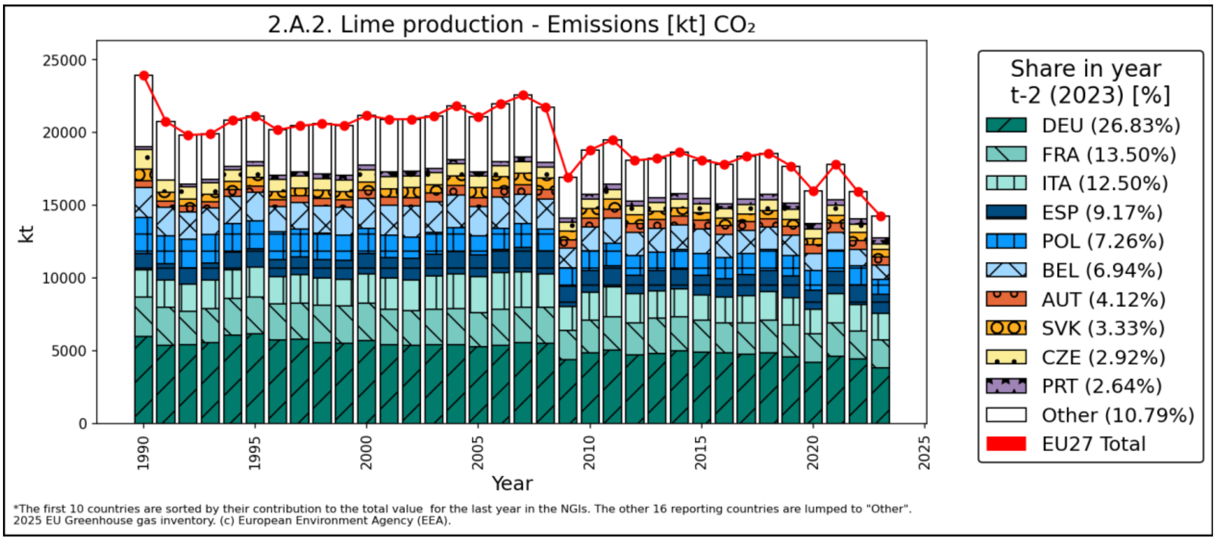
Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	2 033	1 832	1 543	2.5%	-491	-24%	-289	-16%	T3	PS
Belgium	2 824	2 456	2 181	3.6%	-643	-23%	-275	-11%	T3	PS
Bulgaria	2 142	1 039	1 046	1.7%	-1 097	-51%	7	1%	T2	PS
Croatia	1 086	1 099	1 118	1.8%	32	3%	19	2%	T2,T3	PS
Cyprus	668	880	938	1.5%	271	41%	59	7%	CS	CS
Czechia	2 489	1 847	1 483	2.4%	-1 006	-40%	-364	-20%	T3	PS
Denmark	775	1 073	982	1.6%	207	27%	-92	-9%	T3	PS
Estonia	483	NO	NO	-	-483	-100%	-	-	NA	NA
Finland	729	597	445	0.7%	-284	-39%	-152	-25%	T3	PS
France	10 937	6 397	5 675	9.3%	-5 262	-48%	-721	-11%	T2,T3	CS,PS
Germany	15 297	12 538	10 765	17.6%	-4 532	-30%	-1 772	-14%	T2	CS
Greece	5 762	2 905	2 998	4.9%	-2 763	-48%	94	3%	CS	PS
Hungary	1 751	815	544	0.9%	-1 207	-69%	-270	-33%	T3	PS
Ireland	884	1 957	1 835	3.0%	951	108%	-121	-6%	T3	PS
Italy	15 846	7 093	6 746	11.0%	-9 100	-57%	-348	-5%	T2	CS,PS
Latvia	346	540	531	0.9%	185	54%	-9	-2%	T2	PS
Lithuania	1 668	682	498	0.8%	-1 170	-70%	-184	-27%	T2	PS
Luxembourg	539	369	241	0.4%	-298	-55%	-128	-35%	T2	CS,PS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	416	NO	NO	-	-416	-100%	-	-	NA	NA
Poland	5 453	7 663	6 602	10.8%	1 149	21%	-1 061	-14%	T2	CS
Portugal	3 176	2 229	2 076	3.4%	-1 100	-35%	-152	-7%	T3	PS
Romania	4 445	3 723	3 721	6.1%	-724	-16%	-2	0%	CS,T2	PS
Slovakia	1 464	1 490	1 294	2.1%	-170	-12%	-195	-13%	T2	PS
Slovenia	470	490	455	0.7%	-15	-3%	-35	-7%	T3	PS
Spain	12 279	7 715	7 480	12.2%	-4 799	-39%	-235	-3%	T3	CS
Sweden	1 272	C	C	-	-1 272	-100%	-	-	T3	PS
EU-27	**95 237**	**67 428**	**61 198**	**100%**	**-34 039**	**-36%**	**-6 230**	**-9%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2022 and 2023 in this table do not include emissions from Sweden for confidentiality reasons, but the 1990 EU sum does include emissions from Sweden.

4.3.1.2 2A2 Lime production

CO_2 emissions from 2A2 Lime production account for 0.5 % of total EU emissions (without LULUCF) in 2023. Between 1990 and 2023, CO_2 emissions from this category decreased by 40 %. Compared to 2022, emissions were 10 % lower in 2023 (Figure 4.4 and Table **4.5**).

Figure 4.4 2A2 Lime production: EU CO_2 emissions



.Table 4.5 2A2 Lime production: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	456	624	588	4.1%	132	29%	-36	-6%	T3	PS
Belgium	2 097	1 115	991	6.9%	-1 106	-53%	-124	-11%	T3	PS
Bulgaria	390	325	235	1.6%	-155	-40%	-89	-27%	T2	D
Croatia	157	111	97	0.7%	-60	-38%	-14	-13%	T3	PS
Cyprus	5	4	6	0.0%	1	12%	2	52%	T1	D
Czechia	1 337	556	417	2.9%	-920	-69%	-139	-25%	T3	PS
Denmark	105	59	60	0.4%	-46	-43%	0	1%	T2	PS
Estonia	119	19	19	0.1%	-100	-84%	0	-2%	T2	PS
Finland	401	260	253	1.8%	-147	-37%	-6	-2%	T3	CS
France	2 712	1 918	1 927	13.5%	-785	-29%	9	0%	T1,T2,T3	CS,D,PS
Germany	5 987	4 437	3 830	26.8%	-2 156	-36%	-607	-14%	T2	D
Greece	404	177	150	1.1%	-254	-63%	-26	-15%	CS	PS
Hungary	614	104	64	0.4%	-550	-90%	-40	-39%	T3	PS
Ireland	214	107	97	0.7%	-117	-55%	-11	-10%	T3	PS
Italy	1 877	1 829	1 785	12.5%	-93	-5%	-44	-2%	T2	CS,PS
Latvia	122	NO	NO	-	-122	-100%	-	-	NA	NA
Lithuania	210	1	2	0.0%	-209	-99%	0	20%	T2	D
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	1	NO	NO	-	-1	-100%	-	-	NA	NA
Netherlands	163	199	189	1.3%	26	16%	-11	-5%	CS	D
Poland	2 461	1 343	1 037	7.3%	-1 424	-58%	-306	-23%	T2	CS
Portugal	206	371	376	2.6%	170	83%	6	2%	T1,T3	D,OTH,PS
Romania	1 450	454	325	2.3%	-1 124	-78%	-128	-28%	T2	CS,D
Slovakia	795	532	475	3.3%	-320	-40%	-57	-11%	T2	PS
Slovenia	200	51	43	0.3%	-157	-78%	-8	-16%	T3	PS
Spain	1 109	1 325	1 309	9.2%	200	18%	-16	-1%	T3	PS
Sweden	332	C	C	-	-332	-100%	-	-	T3	D
EU-27	**23 924**	**15 923**	**14 275**	**100%**	**-9 649**	**-40%**	**-1 648**	**-10%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions. EU trends for 2023 in this table do not include emissions from Sweden for confidentiality reasons, but 2022 and 2023 EU sums do include emissions from Sweden.

4.3.1.3 2A4 Other process uses of carbonates

CO_2 emissions from 2A4 Other process uses of carbonates contributed 0.3 % of total EU emissions (without LULUCF) in 2023. Emissions from this category in 2022 were 29 % below 1990 levels and 23 % below 2022 levels (Table **4.6**).

Table 4.6 2A4 Other process uses of carbonates: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	610	426	396	5.0%	-215	-35%	-31	-7%	T1,T3	D,PS
Belgium	136	196	175	2.2%	38	28%	-21	-11%	NA,T3	CS,NA,PS
Bulgaria	607	1 196	646	8.2%	39	6%	-550	-46%	NA,T1,T2	D,NA,PS
Croatia	11	15	13	0.2%	2	19%	-1	-9%	NA,T3	NA,PS
Cyprus	44	17	16	0.2%	-28	-63%	-1	-4%	CS,NA,T1	CS,D,NA
Czechia	114	731	564	7.2%	450	395%	-167	-23%	NA,T1,T3	D,NA,PS
Denmark	77	73	60	0.8%	-17	-22%	-13	-18%	NA,T3	CS,D,NA
Estonia	IE,NA,NO	3	4	0.0%	4	∞	0	11%	NA,T1,T2	D,NA,PS
Finland	67	82	65	0.8%	-3	-4%	-17	-20%	NA,T1,T3	CS,D,NA
France	488	450	378	4.8%	-110	-22%	-72	-16%	NA,T1,T2,T3	CS,D,NA,PS
Germany	1 458	836	595	7.6%	-863	-59%	-241	-29%	NA,T1,T2	CS,D,NA
Greece	590	243	216	2.7%	-373	-63%	-27	-11%	CS,T1	CS,D
Hungary	449	177	123	1.6%	-326	-73%	-54	-31%	NA,T2,T3	CS,D,NA,PS
Ireland	5	4	2	0.0%	-3	-61%	-2	-52%	NA,T3	NA,PS
Italy	2 544	644	534	6.8%	-2 010	-79%	-110	-17%	NA,T2	CS,NA,PS
Latvia	69	7	5	0.1%	-64	-92%	-1	-20%	NA,T1,T2	D,NA,PS
Lithuania	240	13	10	0.1%	-230	-96%	-3	-27%	NA,T1,T2	CS,D,NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	0	0	0	0.0%	0	-12%	0	22%	NA,T1	D,NA
Netherlands	690	891	700	8.9%	11	2%	-190	-21%	NA,T1	D,NA
Poland	771	2 620	2 120	26.9%	1 348	175%	-500	-19%	NA,T1,T2	CS,D,NA
Portugal	220	263	114	1.4%	-106	-48%	-149	-57%	IE,NO,T1,T3	IE,NO,OTH
Romania	38	269	197	2.5%	159	415%	-72	-27%	NA,OTH,T2,T3	D,NA,PS
Slovakia	447	294	210	2.7%	-237	-53%	-84	-29%	NA,T3	NA,PS
Slovenia	20	18	15	0.2%	-5	-24%	-2	-14%	NA,T2	D,NA
Spain	1 358	794	715	9.1%	-643	-47%	-80	-10%	T1,T2,T3	CS,D,PS
Sweden	15	5	4	0.1%	-11	-72%	-1	-21%	T3	D
EU-27	**11 068**	**10 267**	**7 877**	**100%**	**-3 192**	**-29%**	**-2 391**	**-23%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.1.4 Non-key sources

Glass production is the only non-key source in the mineral industry. CO_2 emissions from 2A3 Glass production contributed 0.1 % of total EU emissions (without LULUCF) in 2023. Emissions in that year were approximately 8 % below 1990 levels and 10 % below 2022 levels (Table **4.7**).

Table 4.7 2A3 Glass production: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	39	35	35	1.0%	-4	-10%	0	-1%	T3	PS
Belgium	263	149	142	4.0%	-120	-46%	-7	-4%	T3	CS,PS
Bulgaria	138	91	41	1.2%	-97	-70%	-50	-55%	T1	CS
Croatia	43	30	31	0.9%	-12	-28%	1	3%	T3	PS
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	143	146	132	3.7%	-10	-7%	-13	-9%	T3	PS
Denmark	16	11	10	0.3%	-6	-37%	0	-3%	T3	PS
Estonia	1	10	10	0.3%	9	702%	0	-3%	T3	PS
Finland	21	2	1	0.0%	-20	-93%	-1	-28%	T3	CS
France	802	498	416	11.8%	-386	-48%	-82	-16%	T2,T3	CS,PS
Germany	780	916	787	22.3%	7	1%	-129	-14%	T2	CS
Greece	20	18	16	0.4%	-4	-22%	-2	-12%	CS	CS
Hungary	77	33	17	0.5%	-60	-78%	-16	-49%	T3	CS,PS
Ireland	13	NO	NO	-	-13	-100%	-	-	NA	NA
Italy	453	592	579	16.4%	125	28%	-14	-2%	T2	CS,PS
Latvia	0	1	1	0.0%	1	158%	0	31%	T3	D,PS
Lithuania	12	7	6	0.2%	-6	-50%	-1	-15%	T2	D
Luxembourg	54	2	4	0.1%	-50	-93%	1	57%	CS	PS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	142	67	68	1.9%	-74	-52%	1	2%	T3	PS
Poland	169	588	577	16.3%	407	241%	-12	-2%	T2	D
Portugal	69	158	159	4.5%	90	131%	1	1%	T3	OTH
Romania	150	71	61	1.7%	-89	-59%	-9	-13%	T2	CS,D
Slovakia	8	16	13	0.4%	5	59%	-4	-23%	T3	PS
Slovenia	3	15	13	0.4%	10	303%	-2	-12%	T3	D
Spain	374	451	402	11.4%	28	7%	-48	-11%	T3	CS,D,PS
Sweden	54	16	16	0.5%	-37	-70%	0	1%	T3	CS,D,PS
EU-27	**3 845**	**3 921**	**3 537**	**100%**	**-308**	**-8%**	**-384**	**-10%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.2 Chemical industry (CRT Source Category 2B)

The chemical industry includes six key categories, which are presented in Table 4.8.

Table 4.8: Key source categories for level and trend analyses and share of MS emissions using higher tier methods for 2B Chemical Industry

Source category	kt CO_2 equ		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
2.B.1. Ammonia production: no classification (CO_2)	31624	13813	T	L	L	98.9 %
2.B.2. Nitric acid production: no classification (N_2O)	40776	1534	T	L	0	100 %
2.B.3. Adipic acid production: no classification (N_2O)	33558	66	T	L	0	100 %
2.B.8. Petrochemical and carbon black production: no classification (CO_2)	13603	12921	T	L	L	93.1 %
2.B.9. Fluorochemical production: no classification (Unspecified mix of HFCs and PFCs)	4787	25	T	0	0	100 %
2.B.10. Other: no classification (CO_2)	9169	13927	T	L	L	97.0 %

The key categories 2B1 Ammonia production, 2B10 Other chemical industry, and 2B8 Petrochemical and carbon black production account for approx. 30 % each of the total GHG emissions in the chemical industry. As categories 2B8 and 2B10 comprise a variety of emission sources, including minor ones, several countries use Tier 1 methods to estimate emissions from some of these sources. Figure 4.5 shows the time series of chemical industry CO_2 emissions. Notable decreases occurred during the 2009 economic crisis, and in 2022 due to high prices of fuels and feedstocks, such as natural gas.

Figure 4.5 2B Chemical industry CO_2 emissions

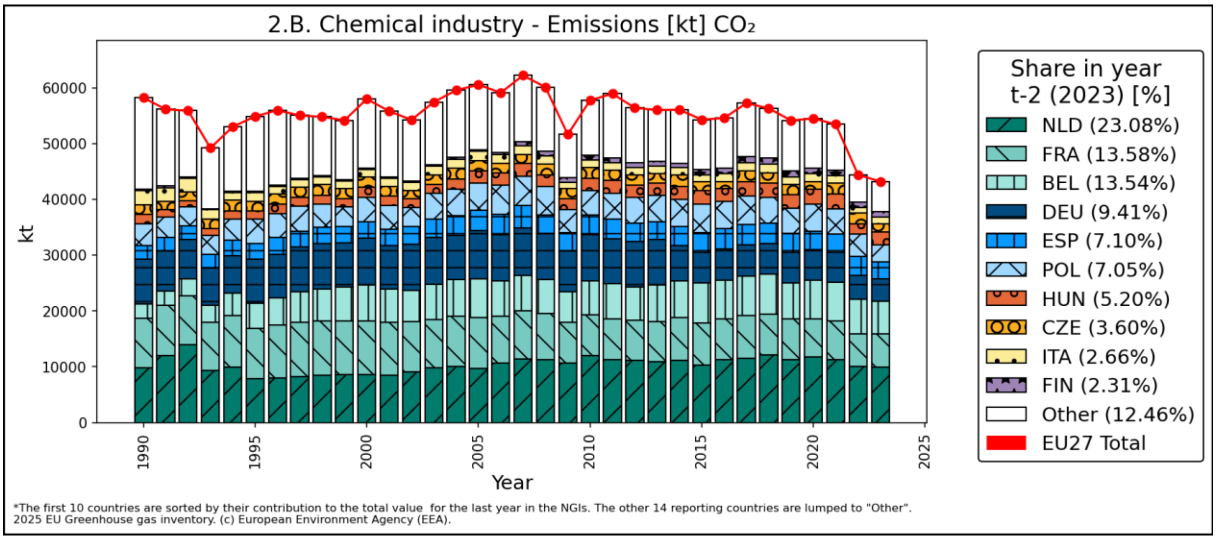


Table 4.9 shows chemical industry CO_2, CH_4, N_2O and total GHG emissions in CO_2 equivalents. Total CO_2 emissions also include F-gas emissions. Between 1990 and 2023 overall GHG emissions from the chemical industry sector have decreased markedly, largely due to the significant reduction in N_2O emissions which have decreased by approx. 97 %.

Table 4.9 2B Chemical industry: EU CO_2, N_2O, CH_4 and total emissions as CO_2 equivalents

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023	1990	2023
Austria	1 464	670	644	589	780	27	41	53
Belgium	9 563	6 277	2 590	5 852	3 385	378	20	15
Bulgaria	4 762	1 034	3 283	958	1 465	75	15	NA,NO
Croatia	1 428	219	751	202	671	18	6	IE,NE,NO
Cyprus	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Czechia	2 825	1 719	1 783	1 557	1 002	116	41	46
Denmark	892	43	1	2	892	42	NA,NO	NA,NO
Estonia	308	NO	308	NO	NO	NO	NO	NO
Finland	1 697	1 105	277	996	1 415	106	5	3
France	35 597	6 267	8 865	5 869	21 187	277	125	31
Germany	32 360	4 771	8 058	4 067	19 075	201	440	479
Greece	2 621	455	681	449	948	7	1	NA,NO
Hungary	4 472	2 315	1 704	2 248	2 748	28	20	39
Ireland	1 875	NA,NO	990	NO	885	NO	NO	NO
Italy	9 626	1 373	2 524	1 149	5 707	47	69	3
Latvia	NO	NO	NO	NO	NO	NO	NO	NO
Lithuania	2 061	1 029	1 261	922	794	108	6	NO
Luxembourg	NO	NO	NO	NO	NO	NO	NO	NO
Malta	0	0	0	0	NA,NO	NA,NO	NA,NO	NA,NO
Netherlands	21 129	10 838	9 833	9 971	6 288	415	310	365
Poland	6 991	3 457	3 802	3 047	3 144	370	45	40
Portugal	1 898	170	1 409	140	460	24	29	6
Romania	9 324	390	5 591	372	3 677	15	56	3
Slovakia	1 834	966	761	918	1 073	47	0	0
Slovenia	88	48	83	48	NA,NO	NA,NO	5	NA,NO
Spain	7 610	3 405	2 430	3 066	2 539	240	94	99
Sweden	1 297	792	582	785	714	6	1	1
EU-27	**161 723**	**47 344**	**58 209**	**43 208**	**78 849**	**2 546**	**1 328**	**1 182**

Note: Presented methods and emission factor information refer to the last inventory year. Abbreviations are explained in the Chapter 'Units and abbreviations'. Emissions from F-gases are not shown in separate columns but are included in the total GHG emissions.

4.3.2.1 2B1 Ammonia production

In most facilities, anhydrous ammonia is produced by catalytic steam reforming of natural gas or fuel oil. At plants using this process, CO_2 is primarily released during regeneration of the CO_2 scrubbing solution, with additional but relatively minor emissions resulting from condensate stripping.

CO_2 emissions from ammonia production contributed 0.5 % of total EU emissions (without LULUCF) in 2023. Emissions have decreased by approx. 56 % since 1990 and by approx. 5 % since 2022 (Figure 4.6 and Table 4.10). The decrease in GHG emissions after 2021 can largely be explained by a decline in ammonia production as a consequence of high natural gas prices.

Figure 4.6 2B1 Ammonia production: CO_2 emissions

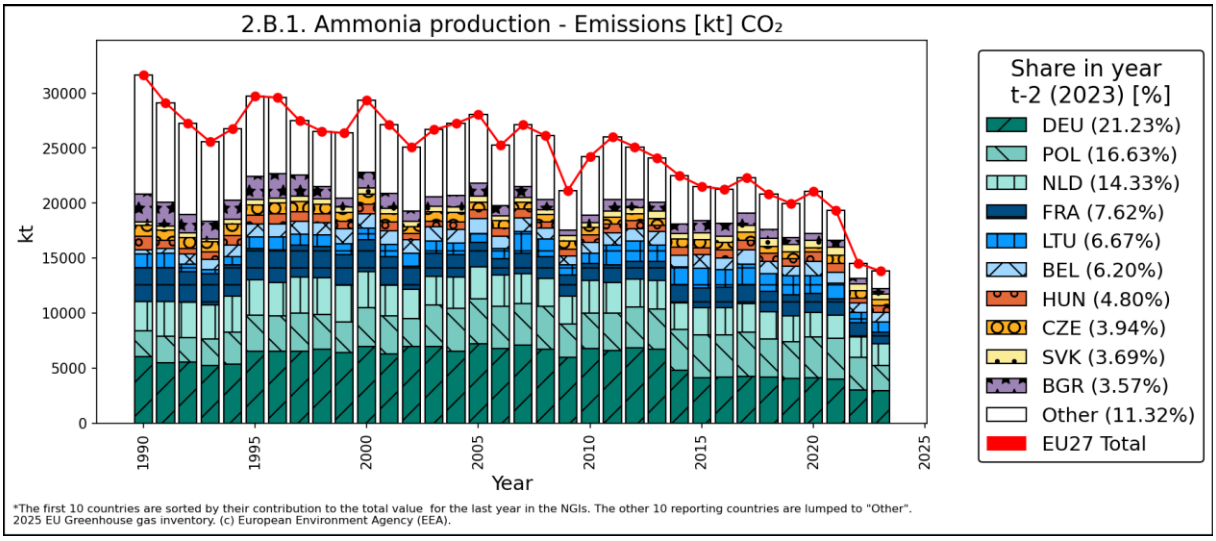


Table 4.10 2B1 Ammonia production: Member States' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	467	419	447	3.2%	-21	-4%	27	7%	T3	PS
Belgium	423	866	856	6.2%	433	103%	-10	-1%	T3	D,PS
Bulgaria	2 508	486	493	3.6%	-2 015	-80%	7	2%	T2	PS
Croatia	559	84	202	1.5%	-357	-64%	118	141%	T3	PS
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	991	682	545	3.9%	-446	-45%	-138	-20%	T2	CS
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	308	NO	NO	-	-308	-100%	-	-	NA	NA
Finland	93	NO	NO	-	-93	-100%	-	-	NA	NA
France	3 056	1 340	1 053	7.6%	-2 003	-66%	-287	-21%	T2,T3	CS,PS
Germany	6 025	3 024	2 932	21.2%	-3 093	-51%	-92	-3%	T3	PS
Greece	652	261	148	1.1%	-504	-77%	-114	-43%	T1a	CS
Hungary	1 200	419	663	4.8%	-537	-45%	244	58%	T3	PS
Ireland	990	NO	NO	-	-990	-100%	-	-	NA	NA
Italy	1 892	247	386	2.8%	-1 506	-80%	139	56%	T2	PS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	1 237	928	922	6.7%	-315	-25%	-7	-1%	T3	CS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	2 695	1 838	1 979	14.3%	-716	-27%	142	8%	T3	CS
Poland	2 344	2 940	2 297	16.6%	-48	-2%	-643	-22%	T2	CS
Portugal	763	NO	NO	-	-763	-100%	-	-	NA	NA
Romania	4 690	100	98	0.7%	-4 592	-98%	-2	-2%	T3	PS
Slovakia	332	638	510	3.7%	178	54%	-128	-20%	T3	PS
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	400	267	284	2.1%	-116	-29%	17	6%	T3	PS
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**31 624**	**14 539**	**13 813**	**100%**	**-17 811**	**-56%**	**-726**	**-5%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations are explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.2.2 2B2 Nitric acid production

N_2O can be emitted in the production of nitric acid as a by-product of the high temperature catalytic oxidation of ammonia. Emissions in the EU have decreased by 96 % since 1990. All countries have had marked emission reductions from this source, notably from 2008 onwards, when N_2O emissions from nitic acid production were included in the EU ETS. The substantial decrease is largely due to technical measures that have been implemented at all nitric acid plants. Special catalysts and improvement of the process efficiency led to a continuation of the declining trend in emissions. Between 2022 and 2023, emissions decreased by 18 % (Figure **4.7** and Table 4.11), and N_2O emissions from nitric acid production contributed less than 0.1 % of total EU emissions (without LULUCF) in 2022.

Figure 4.7 2B2 Nitric acid production N_2O emissions

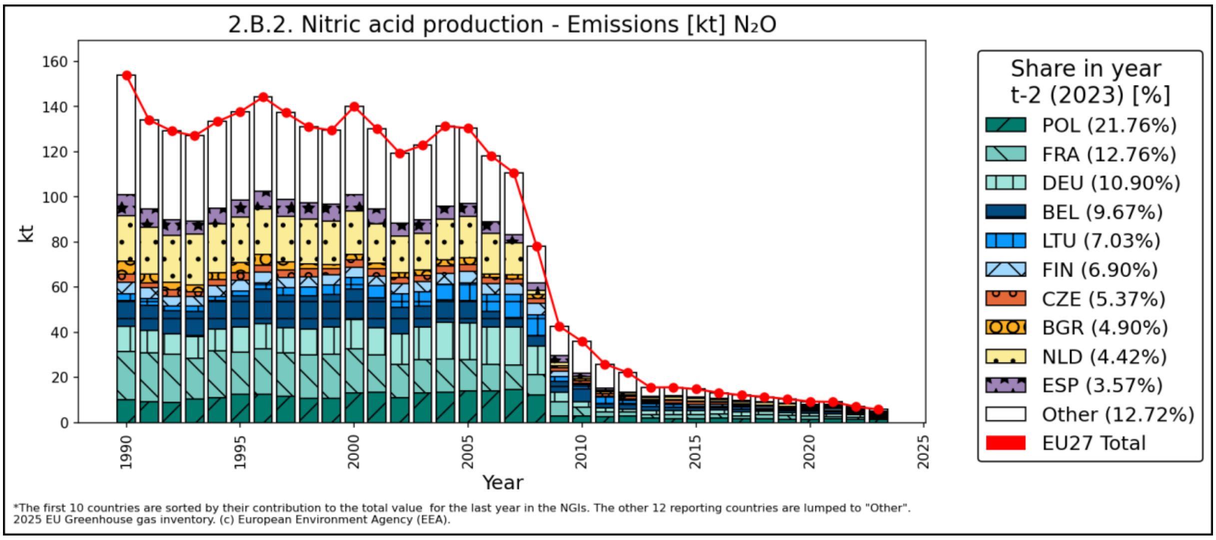


Table 4.11 2B2 Nitric acid production: Member States' contributions to N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	780	23	27	1.8%	-752	-97%	4	19%	T3	PS
Belgium	3 043	165	148	9.7%	-2 894	-95%	-17	-10%	T3	PS
Bulgaria	1 465	66	75	4.9%	-1 390	-95%	9	14%	T3	PS
Croatia	671	12	18	1.1%	-653	-97%	5	43%	T3	PS
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	933	104	82	5.4%	-850	-91%	-22	-21%	T3	PS
Denmark	892	NO	NO	-	-892	-100%	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 415	145	106	6.9%	-1 310	-93%	-39	-27%	T3	PS
France	5 663	225	196	12.8%	-5 467	-97%	-30	-13%	T2,T3	CS,PS
Germany	2 897	299	167	10.9%	-2 730	-94%	-132	-44%	T3	PS
Greece	948	7	7	0.4%	-941	-99%	0	0%	CS	CS
Hungary	2 748	23	28	1.8%	-2 719	-99%	5	24%	T3	PS
Ireland	885	NO	NO	-	-885	-100%	-	-	NA	NA
Italy	1 783	21	25	1.6%	-1 759	-99%	3	16%	T3	D,PS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	794	91	108	7.0%	-686	-86%	17	19%	T3	PS
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	5 411	134	68	4.4%	-5 343	-99%	-66	-49%	T2	PS
Poland	2 704	397	334	21.8%	-2 370	-88%	-63	-16%	T2	CS
Portugal	460	28	24	1.6%	-436	-95%	-4	-14%	T1,T3	D,PS
Romania	3 089	15	15	1.0%	-3 074	-100%	0	1%	T3	PS
Slovakia	1 073	53	47	3.0%	-1 026	-96%	-6	-11%	T3	PS
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	2 428	59	55	3.6%	-2 373	-98%	-4	-7%	T3	PS
Sweden	696	6	5	0.4%	-690	-99%	0	-1%	T2	PS
EU-27	**40 776**	**1 872**	**1 534**	**100%**	**-39 242**	**-96%**	**-338**	**-18%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.2.3 2B3 Adipic acid production

Adipic acid production emits N_2O as a by-product when a cyclohexanone/cyclohexanol mixture is oxidized by nitric acid. N_2O emissions from adipic acid production have been reduced through catalytic and thermal abatement technologies and now account for less than 0.01% of total EU emissions (without LULUCF). Between 1990 and 2023, N_2O emissions from this source decreased by 99.8 % (Figure 4.8 and Table **4.12**). Emissions in 2023 were 17 % lower than in 2022.

Figure 4.8 2B3 Adipic acid production N_2O emissions

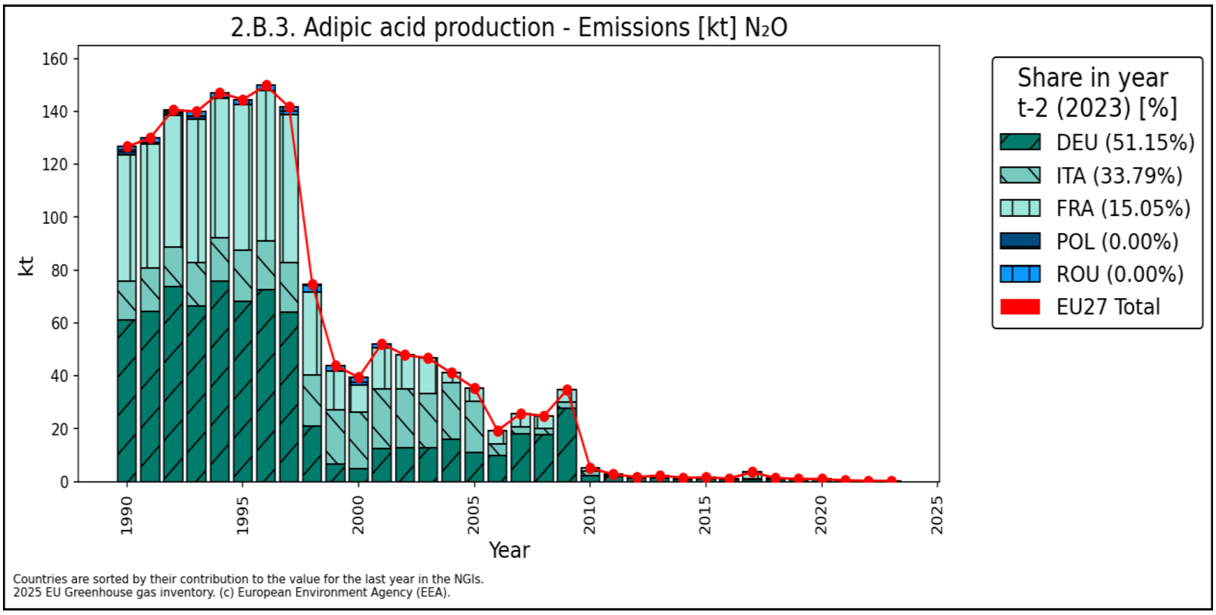


Table 4.12 2B3 Adipic acid production: Member States' contributions to N_2O emissions

Member State	N2O Emissions in kt CO2 equiv. 1990	2022	2023	Share in EU-27 Emissions in 2023	Change 1990-2023 kt CO2 equiv.	%	Change 2022-2023 kt CO2 equiv.	%	Method	Emission factor Information
France	12 656	15	10	15.1%	-12 646	-100%	-5	-33%	T2,T3	CS,PS
Germany	16 178	50	34	51.2%	-16 145	-100%	-16	-32%	T3	PS
Italy	3 914	15	22	33.8%	-3 892	-99%	8	52%	T3	D,PS
Poland	318	NO	NO	-	-318	-100%	-	-	NA	NA
Romania	490	NO	NO	-	-490	-100%	-	-	NA	NA
EU-27	**33 558**	**79**	**66**	**100%**	**-33 492**	**-100%**	**-13**	**-17%**	**-**	**-**

Note: *Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations explained in the Chapter 'Units and abbreviations'.*
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.2.4 2B8 Petrochemical and carbon black production

The European Union has a significant petrochemical industry, with production of all chemicals included in the 2006 IPCC Guidelines. Seventeen countries report CO_2 emissions from this category for at least part of the period 1990-2023 with this source being a key category of CO_2 emissions in terms of emissions level and trend.

CO_2 emissions from 2B8 Petrochemical and carbon black production decreased by 9 % between 2022 and 2023 and are now approx. 5 % above 1990 levels. They contributed 0.5 % of total EU emissions (without LULUCF) in 2023. Trends vary widely between countries, due to increases and decreases in production of the various chemicals over the past three decades.

Figure 4.9 2B8 Petrochemical and carbon black production: EU CO_2 emissions

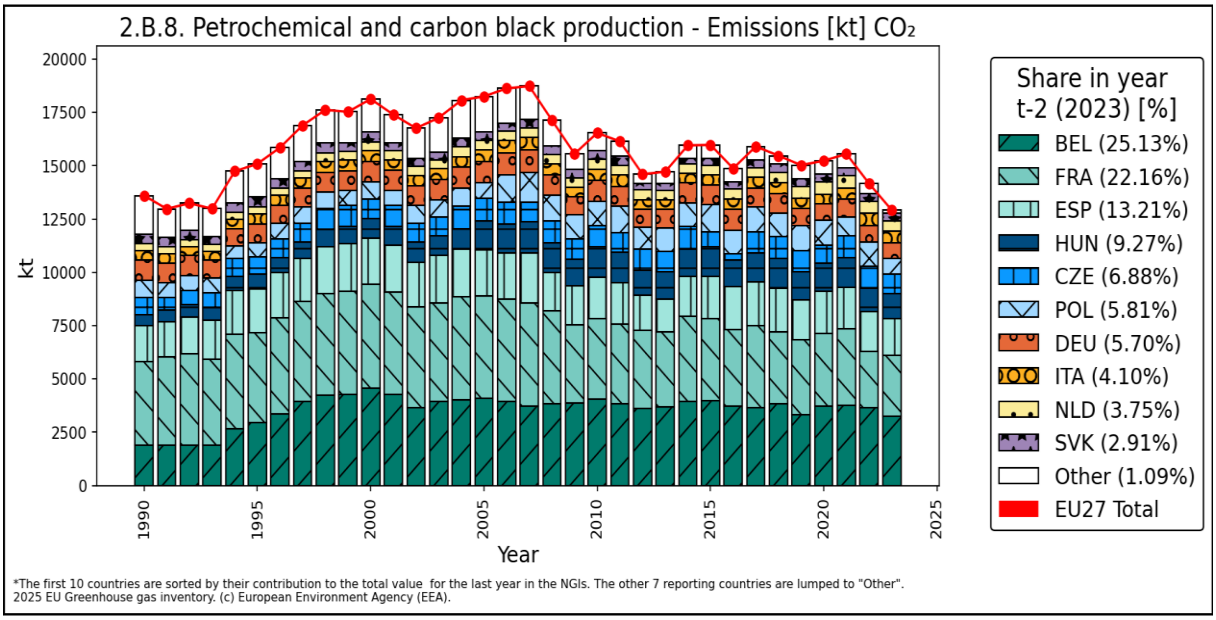


Table 4.13: 2B8 Petrochemical and carbon black production: Member States' contribution to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
Belgium	1 882	3 666	3 247	25.1%	1 365	73%	-418	-11%	NA,T3	NA,PS
Bulgaria	346	NA,NO	NA,NO	-	-346	-100%	-	-	NA	NA
Croatia	192	IE,NO	IE,NO	-	-192	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	792	1 017	889	6.9%	96	12%	-128	-13%	NA,T1,T3	D,NA,PS
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NA	NA
France	3 950	2 615	2 863	22.2%	-1 087	-28%	249	10%	T2,T3	CS,PS
Germany	974	802	736	5.7%	-238	-24%	-65	-8%	NA,T1,T2	CS,D,NA
Greece	29	NO	NO	-	-29	-100%	-	-	NA	NA
Hungary	504	1 115	1 198	9.3%	693	138%	83	7%	NA,T3	NA,PS
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	422	581	529	4.1%	107	25%	-52	-9%	NA,T2	CR,NA,PS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	24	NO	NO	-	-24	-100%	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	336	546	485	3.8%	149	44%	-61	-11%	CS,NA	CS,NA
Poland	806	1 120	751	5.8%	-56	-7%	-369	-33%	NA,T1	D,NA
Portugal	645	479	140	1.1%	-505	-78%	-339	-71%	NA,NO,T1	D,NA,NO
Romania	571	NO	NO	-	-571	-100%	-	-	NA	NA
Slovakia	429	350	376	2.9%	-52	-12%	27	8%	NA,T2	CS,NA,PS
Slovenia	16	NO	NO	-	-16	-100%	-	-	NA	NA
Spain	1 684	1 878	1 707	13.2%	23	1%	-171	-9%	NA,T1,T3	D,NA,PS
Sweden	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-	-	-
EU-27	**13 603**	**14 167**	**12 921**	**100%**	**-681**	**-5%**	**-1 245**	**-9%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations explained in the Chapter 'Units and abbreviations'.
This table lists methods and emission factors in the latest inventory year, as provided by Members States in their national inventory submissions.

4.3.2.5 Chemical industry – Fluorochemical production (CRT Source Category 2.B.9)

In this subcategory, by-product emissions and fugitive emissions are to be reported. Emissions from this subcategory decreased significantly since 1990, which is due to the closure of several production sites in the EU but also the installation of abatement technology as well as process optimisation.

As regards by-product emissions, HFCs account for major shares. Overall, the generation of HFC-23 as a by-product during the manufacture of HCFC-22, HFC-32 and other fluorocarbons is particularly relevant due to its high global warming potential. HFC-23 is primarily generated during the fluorination of chloroform (trichloromethane, CHCl3 or R20). Since chloroform is a feedstock for chlorodifluoromethane (HCFC-22 or R22), HFC-23 is a by-product during the manufacture of this chemical which is nowadays mainly used as feedstock. The HFC-23 yield amounts to 2-3% of the amount of R22 produced. In addition, where R22 is used as an intermediate product or feedstock this may also lead to HFC-23 by-production. This is the case e.g. for some production pathways of difluoromethane (HFC-32 or R32). HFC-32 is widely used as a single substance refrigerant, especially in stationary air conditioning systems, but is also a component of several frequently used refrigerant blends such as the R407 series (10-30% R32) and R410A (50% R32). Production of these blends may therefore also involve HFC-23 by-production. (EU Commission, 2015)

It is estimated that in 1990 the HFC-23 released from HCFC-22 plants was at most 4 percent of the global production of HCFC-22 (U.S. EPA, 2001), in the absence of abatement measures. Before the mid-1990s, ten HCFC-22 plants were operated in Europe. At that time, HFC-23 by-product emissions were partly captured and processed but emissions were also high. In the late 1990s, HFC-23 emissions accounted for about half of the EU's F-gas emissions. Due to the closure of several HCFC production plants and the installation of abatement systems in the remaining facilities, HFC-23 emissions were significantly reduced.

In fluorochemical manufacture also other fluorinated greenhouse gases can occur as by-products including e.g. PFCs such as CF_4, C_2F_6, C_3F_8, C_4F_{10}, C_5F_{12}, C_6F_{14} as well as SF_6. The type and amount of these by-product emissions depends on the applied production pathway and installed abatement technology.

Fugitive emissions are also released during the production process of F-gases. Hence certain amounts of emissions of all types of F-gases that are manufactured in the EU are reported in this subcategory. In the last decades, the production processes have been optimized in all facilities so that fugitive emissions have been significantly reduced.

Germany reports "unspecified mix of HFCs and PFCs" from 2.B.9 for confidentiality reasons (Table 4.15)

Table 4.14: 2B9 Fluorochemical production – HFCs: Countries' contributions to HFC emissions and information on method applied, activity data and emission factor

Member State	HFCs Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Belgium	NO	65	1	0.7%	1	∞	-64	-99%	NA,T3	NA,PS
France	4 202	26	19	18.7%	-4 183	-100%	-7	-26%	T3	PS
Greece	991	NO	NO	-	-991	-100%	-	-	NA	NA
Italy	372	1	1	0.7%	-371	-100%	0	-19%	CS,NA	NA,PS
Netherlands	4 697	144	82	79.9%	-4 615	-98%	-62	-43%	NA,T2	CS,NA
Spain	2 547	NO	NO	-	-2 547	-100%	-	-	NA	NA
EU-27	**12 809**	**236**	**102**	**100%**	**-12 707**	**-99%**	**-133**	**-57%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.15: 2B9 Fluorochemical production: Countries' contributions to Unspecified mix of HFC and PFC emissions and information on method applied, activity data and emission factor

Member State	Unspecified mix of HFCs and PFCs Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Germany	4 787	38	25	100.0%	-4 762	-99%	-13	-35%	NA	NA
EU-27	**4 787**	**38**	**25**	**100%**	**-4 762**	**-99%**	**-13**	**-35%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Presented methods and emission factor information refer to the last inventory year. Abbreviations explained in the Chapter 'Units and abbreviations'.

4.3.2.6 2B10 Other chemical industry

Fourteen countries reported CO_2, CH_4 or N_2O emissions in this category which contributed 14.4 Mt of CO_2eq or 0.5 % of total EU emissions (without LULUCF). Between 1990 and 2023, CO_2 emissions from this source increased by 52 % while CH_4 and N_2O emissions decreased by 6 % and 41 %, respectively. This category contains a wide range of emissions and sources as shown in Table 4.16.

Table 4.16 2B10 Other: CO_2, CH_4 and N_2O emissions for 1990 and 2023

Member State	Category	CO_2 emissions [kt]	CH_4 emissions [kt]	N_2O emissions [kt]	CO_2 emissions [kt]	CH_4 emissions [kt]	N_2O emissions [kt]
		1990			2023		
Austria	CO_2 from nitric acid production	0.41	NA	NA	0.43	NA	NA
	Other chemicals bulk production	138.15	0.34	NA	109.73	0.31	NA
Belgium	Other non-specified	285.15	0.707	0.092	1704.15	0.525	0.293
Czechia	Other non energy use in chemical industry	IE	NO	NO	117.13	NO	NO
	Non selective catalytic reduction	IE	NO	NO	6.47	NO	NO
Denmark	Production of catalysts	0.57	NA	NA	1.55	NA	0.16
Finland	Hydrogen production	116.22	NO	NO	894.87	NO	NO
	Phosphoric Acid Production	24.54	NO	NO	29.60	NO	NO
	Limestone and dolomite use	36.52	NO	NO	70.02	NO	NO
	Chemicals production	6.71	NO	NO	1.85	NO	NO
France	Other chemical industry	1271.99	0.11	1.82	1681.91	0.07	0.14
Germany	Other	NA	2.38	IE	NA	2.32	IE
Greece	Hydrogen production	NO	NO	NO	301.13	NA	NA
Malta	Calcium carbide use	0.17	NA	NA	0.02	NA	NA
Netherlands	Other process emissions	6738.86	0.31	0.83	7507.04	0.39	1.06
Romania	Hydrogen production	18.74	NO	NO	268.80	NO	NO
Slovenia	Hydrogen production	17.43	NA	NA	10.16	NA	NA
Spain	Hydrogen production	NO	NO	NO	834.57	NA	NA
Sweden	Other	514.02	0.03	0.07	C	0.03	0.00
Total		**9169**	**3.87**	**2.81**	**13927**	**3.65**	**1.65**

Note: Abbreviations are explained in the Chapter 'Units and abbreviations'.

4.3.2.7 Non-key sources

Non-key sources in the chemical industry sector include: 2B4 Caprolactam, glyoxal and glyoxylic acid production; 2B5 Carbide production; 2B6 Titanium dioxide production and 2B7 Soda ash production. They also include emissions of CH_4 and N_2O from 2B1 Ammonia production, CO_2 emissions from 2B3 Adipic acid production, CH_4 from 2B8 Petrochemical and carbon black production, and HFC, PFC and SF_6 emissions from 2B9 Fluorochemical production, as well as all gases from 2B10 except CO_2. In 2023 emissions from these categories contributed 4 Mt of CO_2 equivalent or 1.3 % of total emission in the IPPU sector.

4.3.3 Metal Industry (CRT Source Category 2C)

This source category includes two key sources for level and trend, namely CO_2 emissions from 2C1 Iron and Steel Production and PFC emissions from 2C3 Aluminium Production (*Table 4.17*).

Table 4.17: Key source categories for level and trend analyses and share of MS emissions using higher tier methods for sector 2C (Table excerpt).

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
2.C.1. Iron and steel production: no classification (CO_2)	103487	54394	T	L	L	100%
2.C.3 Aluminium Production: no classification (PFCs)	17234	132	T	L	-	100%

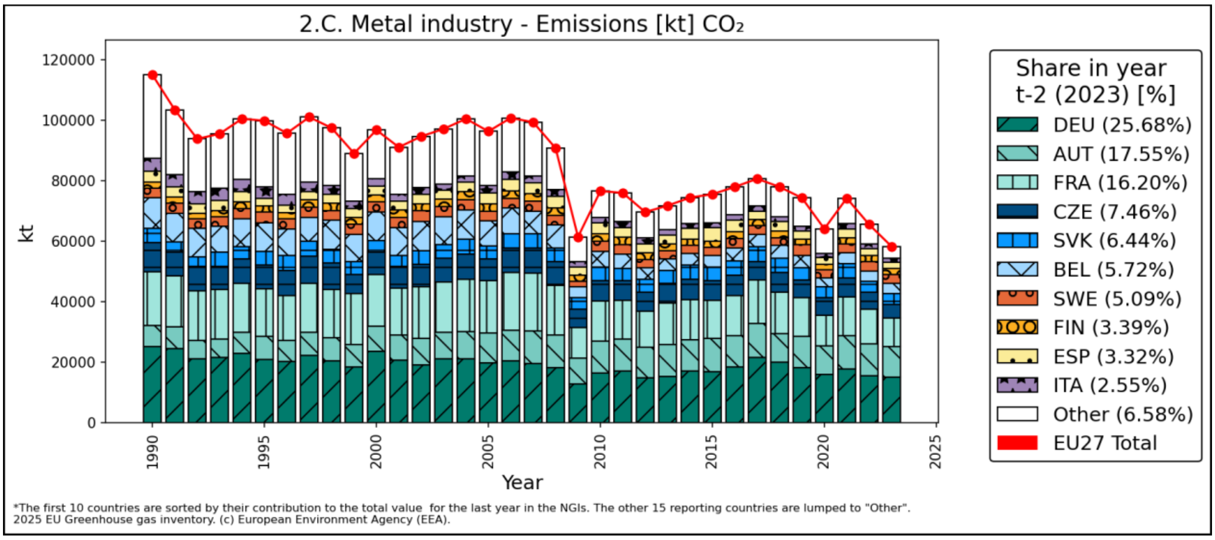
Table 4.18 summarises information by countries on total GHG emissions, CO_2, N_2O, CH_4 and HFC, PFC, NF_3 and SF_6 emissions from Metal Production. Between 1990 and 2023, GHG emissions decreased by 56% and CO_2 emissions from 2C Metal Production decreased by 49%. The largest absolute reductions in GHG emissions between 1990 and 2023 were observed in Romania, Germany, France, Belgium and Czech Republic (in descending order).

Table 4.18: Contributions to total GHG, CO_2, HFC, PFC and SF_6 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		HFC emissions in kt CO2 equivalents		PFC emissions in kt CO2 equivalents		SF6 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023	1990	2023	1990	2023
Austria	8 304	10 223	7 016	10 214	-	-	1 032	NO	249	2
Belgium	10 107	3 334	10 092	3 329	NO	NO	NO	NO	-	-
Bulgaria	1 633	158	1 603	158	NO	NO	NO	NO	NO	NO
Croatia	1 458	18	336	18	NO	NO	1 117	NO	-	-
Cyprus	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NO	NO	NA	NA
Czechia	9 812	4 355	9 795	4 345	NO	NO	NO	NO	NO	NO
Denmark	61	0	30	0	NO	NO	NO	NO	31	NO
Estonia	1	3	1	3	NO	NO	NO	NO	NO	NO
Finland	1 976	1 975	1 976	1 975	NO	NO	NO	NO	NO	NO
France	21 791	9 475	17 679	9 433	-	-	3 211	20	743	2
Germany	27 901	15 078	25 080	14 951	NA,NO	10	2 597	15	186	83
Greece	1 183	478	1 012	414	NO	NO	171	64	NO	NO
Hungary	3 663	298	3 317	297	NO	NO	338	NO	NO	NO
Ireland	26	NA,NO	26	NA,NO	NO	NO	NO	NO	NO	NO
Italy	6 232	1 523	4 378	1 485	NO	4	1 778	NO	NO	NO
Latvia	70	NO	70	NO	NO	NO	NO	NO	NO	NO
Lithuania	17	0	17	0	NO	NO	NO	NO	NO	NO
Luxembourg	985	89	985	89	NO	NO	NO	NO	-	-
Malta	NO	NO	NO	NO	NO	NO	NO	NO	-	-
Netherlands	2 826	9	452	9	NO	NO	2 374	NO	NA	NA
Poland	5 805	1 364	5 652	1 357	NO	NO	127	NO	NO	NO
Portugal	447	78	446	78	NA,NO	NO	NA,NO	NO	-	-
Romania	15 782	1 360	13 228	1 358	NO	NO	2 530	1	NA,NO	NA,NO
Slovakia	4 815	3 766	4 586	3 749	-	-	214	0	-	-
Slovenia	530	51	343	51	NO	NO	187	1	NO	NO
Spain	4 615	1 952	3 537	1 935	NA,NO	NA,NO	1 046	NA,NO	NA,NO	NA,NO
Sweden	3 829	2 996	3 273	2 964	NO	1	511	31	24	NO
EU-27	**133 868**	**58 583**	**114 930**	**58 210**	**NA,NO**	**15**	**17 234**	**132**	**1 232**	**88**

Note: Total GHG emissions given in this table include CO_2, N_2O, CH_4, HFC, PFC and SF_6. Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 4.10: 2C Metal Industry CO_2 – Trend in the EU



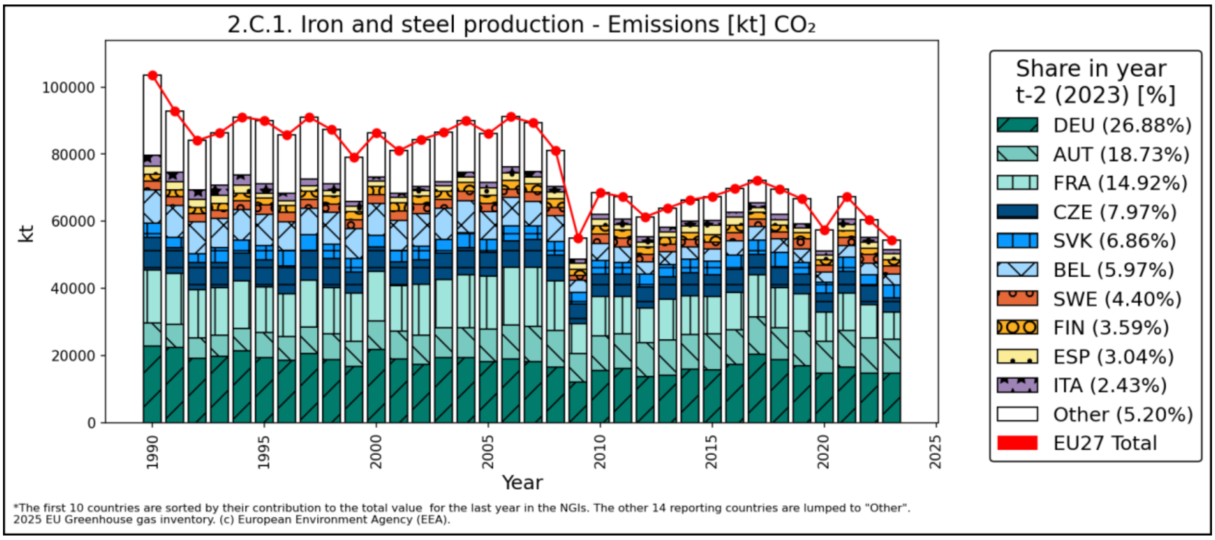
4.3.3.1 2C1 Iron and steel production

This source category includes emissions from the iron and steel industry. Crude iron is produced by the reduction of iron oxide ores mostly in blast furnaces, using coke or other forms of carbon as fuel and reducing agent. In most iron furnaces, the process is aided by the use of carbonate fluxes (limestone). Additional emissions occur as the limestone or dolomite flux releases CO_2 during reduction of pig iron in the blast furnace. Coke plays the dual role of fuel and reducing agent. Countries use different methods for the allocation of emissions between energy (CRT 1A2a) and non-energy (CRT 2C1) uses, which are described in Table 4.19.

CO_2 emissions from 2C1 Iron and Steel Production amounted to approximately 1.87% of total GHG emissions (including indirect CO_2 and LULUCF, but without international aviation) in 2023. The three major contributors are Germany, which accounts for 26.9% (14,619 kt) of the CRT 2C1 emissions in the EU KP, Austria with 18.7% (10,188 kt) and France with 14.9% (8,115 kt), in 2023. Romania had the largest decrease in absolute terms between 1990 and 2023 (-11,378 kt CO_2, which corresponds to -90%), before Germany (-36%) and France (-49%). Unlike other EU MS, the CO_2 emissions of CRT 2C1 from Austria have increased over the timeseries (+49%) and is now one of the main contributors, whereas it represented less than 7% of the sectoral CO_2 emissions in 1990.

The overall emission trend between 1990 and 2023 roughly follows the trend of the production figures (see Figure 4.11). Between 1990 and 2023, overall CO_2 emissions from iron and steel production decreased by 47% (Table 4.19). Between 2022 and 2023, emissions have been reduced by 9.9%, which correspond to an absolute reduction of 6,009 kt CO_2, mostly due to the large reductions in France (1,934 kt, i.e. -19%), Romania (1,658 kt, i.e., -57%) and Czech Republic (-1,246 kt, i.e., -22%).

Figure 4.11 2C1 Iron and steel production: CO_2 emissions



For the whole timeseries, CO_2 emissions from iron and steel industry are reported by all countries except Cyprus, Estonia and Malta. Denmark, Ireland and Latvia reported emissions from this sector in 1990, but no longer from 2019. All countries follow higher-tier methods and most use country or plant specific methods (seeTable 4.19).

Table 4.19 2C1 Iron and Steel Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	6 840	10 414	10 188	18.7%	3 347	49%	-227	-2%	NA,T3	NA,PS
Belgium	10 048	3 417	3 249	6.0%	-6 799	-68%	-168	-5%	CS,NA,T3	NA,PS
Bulgaria	1 283	11	12	0.0%	-1 271	-99%	1	13%	NA,T2	CS,NA
Croatia	44	13	18	0.0%	-26	-59%	5	34%	NA,T3	NA,PS
Cyprus	NA,NO	NA,NO	NA,NO	-	-	-	-	-	NA	NA
Czechia	9 782	5 581	4 334	8.0%	-5 448	-56%	-1 246	-22%	CS,NA,T2	CS,D,NA,PS
Denmark	30	NO	NO	-	-30	-100%	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 967	1 957	1 953	3.6%	-14	-1%	-3	0%	CS,NA,T3	CS,NA
France	15 789	10 048	8 115	14.9%	-7 674	-49%	-1 934	-19%	T2,T3	CS,PS
Germany	22 810	14 743	14 619	26.9%	-8 191	-36%	-124	-1%	NA,T2	CS,NA
Greece	105	82	65	0.1%	-40	-38%	-17	-20%	NA	NA,PS
Hungary	3 155	637	297	0.5%	-2 858	-91%	-340	-53%	NA,T3	NA,PS
Ireland	26	NA,NO	NA,NO	-	-26	-100%	-	-	NA	NA
Italy	3 124	1 392	1 324	2.4%	-1 800	-58%	-68	-5%	NA,T2	CR,CS,NA,PS
Latvia	70	NO	NO	-	-70	-100%	-	-	NA	NA
Lithuania	17	0	0	0.0%	-17	-100%	0	-6%	NA,T2	D,NA
Luxembourg	985	79	87	0.2%	-898	-91%	7	9%	CS,NA,T2	CS,NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	44	16	9	0.0%	-35	-80%	-7	-46%	NA,T2	NA,PS
Poland	4 959	1 422	995	1.8%	-3 964	-80%	-427	-30%	NA,T2	CS,NA
Portugal	440	54	61	0.1%	-378	-86%	7	13%	NO,T1,T3	D,NO,PS
Romania	12 621	2 901	1 243	2.3%	-11 378	-90%	-1 658	-57%	NA,T3	CS,NA
Slovakia	4 168	3 324	3 734	6.9%	-434	-10%	410	12%	NA,T2	NA,PS
Slovenia	44	51	44	0.1%	0	1%	-7	-14%	NA,T3	NA,PS
Spain	2 501	1 740	1 656	3.0%	-845	-34%	-85	-5%	NA,T2	CS,NA,PS
Sweden	2 637	2 521	2 392	4.4%	-244	-9%	-129	-5%	NA,T3	NA,PS
EU-27	**103 487**	**60 404**	**54 394**	**100%**	**-49 093**	**-47%**	**-6 009**	**-10%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

For this category (2C1 – Iron and steel), it is not relevant to analyse an average iEF across countries because of their varying emission allocation (the split between process and combustion related emissions for pig iron production, which is an important sub-category) (see Table.4.20).

Table.4.20 2C1a Steel Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	6 821	10 375	10 147	22.6%	3 326	49%	-228	-2%	T3	PS
Belgium	8 445	3 315	3 174	7.1%	-5 270	-62%	-140	-4%	CS,T3	PS
Bulgaria	1 283	11	12	0.0%	-1 271	-99%	1	13%	T2	CS
Croatia	20	13	18	0.0%	-2	-8%	5	34%	T3	PS
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	IE	IE	IE	-	-	-	-	-	NA	NA
Denmark	30	NO	NO	-	-30	-100%	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	1 967	1 957	1 953	4.4%	-14	-1%	-3	0%	CS,T3	CS
France	15 789	10 016	8 087	18.0%	-7 702	-49%	-1 929	-19%	T2,T3	CS,PS
Germany	22 810	14 743	14 619	32.6%	-8 191	-36%	-124	-1%	T2	CS
Greece	105	82	65	0.1%	-40	-38%	-17	-20%	-	PS
Hungary	348	76	38	0.1%	-310	-89%	-38	-50%	T3	PS
Ireland	26	NO	NO	-	-26	-100%	-	-	NA	NA
Italy	1 346	1 095	1 059	2.4%	-287	-21%	-36	-3%	T2	CR,CS,PS
Latvia	70	NO	NO	-	-70	-100%	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	404	79	87	0.2%	-318	-79%	7	9%	CS,T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	43	16	9	0.0%	-34	-80%	-7	-46%	T2	PS
Poland	IE	IE	IE	-	-	-	-	-	NA	NA
Portugal	73	54	61	0.1%	-12	-16%	7	13%	T1,T3	D,PS
Romania	12 621	2 901	1 243	2.8%	-11 378	-90%	-1 658	-57%	T3	CS
Slovakia	4 150	3 314	3 730	8.3%	-420	-10%	416	13%	T2	PS
Slovenia	44	51	44	0.1%	0	1%	-7	-14%	T3	PS
Spain	1 045	530	540	1.2%	-505	-48%	10	2%	T2	CS,PS
Sweden	158	C	C	-	-158	-100%	-	-	T3	PS
EU-27	**77 597**	**48 628**	**44 887**	**100%**	**-32 709**	**-42%**	**-3 741**	**-8%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Table.4.21 2C1b Pig Iron Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	IE	IE	IE	-	-	-	-	-	NA	NA
Belgium	IE	IE	IE	-	-	-	-	-	NA	NA
Bulgaria	IE	NO	NO	-	-	-	-	-	NA	NA
Croatia	24	NO	NO	-	-24	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	IE	IE	IE	-	-	-	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	IE	IE	IE	-	-	-	-	-	T2,T3	CS,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	2 427	396	185	5.4%	-2 242	-92%	-211	-53%	T3	PS
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	1 778	297	265	7.7%	-1 513	-85%	-32	-11%	T2	CR,CS,PS
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	200	NO	NO	-	-200	-100%	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	IE	IE	IE	-	-	-	-	-	NA	NA
Poland	1 043	471	139	4.0%	-904	-87%	-332	-70%	T2	CS
Portugal	298	NO	NO	-	-298	-100%	-	-	NO	NO
Romania	IE	IE	IE	-	-	-	-	-	NA	NA
Slovakia	IE	IE	IE	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	246	655	820	23.9%	574	233%	165	25%	T2	CS
Sweden	2 094	2 126	2 026	59.0%	-68	-3%	-101	-5%	T3	PS
EU-27	**8 109**	**3 945**	**3 435**	**100%**	**-4 675**	**-58%**	**-510**	**-13%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

CO_{2eq} emissions from 2C1c 'Direct Reduced Iron Production' and 2C1e 'Pellet Production' are only reported by Sweden, numerical values for historic years and confidential data in recent years.

Table 4.22 2C1d Sinter Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	IE	IE	IE	-	-	-	-	-	NA	NA
Belgium	1 589	96	70	14.8%	-1 519	-96%	-26	-27%	CS,T3	PS
Bulgaria	IE	NO	NO	-	-	-	-	-	NA	NA
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	IE	IE	IE	-	-	-	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	IE	IE	IE	-	-	-	-	-	NA	NA
France	IE	IE	IE	-	-	-	-	-	T2,T3	CS,PS
Germany	IE	IE	IE	-	-	-	-	-	NA	NA
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	380	165	74	15.7%	-307	-81%	-91	-55%	T3	PS
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	NA	NA	NA	-	-	-	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	380	NO	NO	-	-380	-100%	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	IE	IE	IE	-	-	-	-	-	NA	NA
Poland	841	211	183	38.8%	-658	-78%	-28	-13%	T2	CS
Portugal	69	NO	NO	-	-69	-100%	-	-	T1	D
Romania	IE	IE	IE	-	-	-	-	-	NA	NA
Slovakia	IE	IE	IE	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	538	180	144	30.7%	-393	-73%	-36	-20%	T2	CS
Sweden	222	NO	NO	-	-222	-100%	-	-	-	-
EU-27	**4 019**	**652**	**471**	**100%**	**-3 548**	**-88%**	**-181**	**-28%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Table 4.23 2C1f Other Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	20	39	40	0.9%	21	106%	1	3%	T3	PS
Belgium	14	0	0	0.0%	-14	-98%	0	-31%	CS,T3	PS
Bulgaria	NA	NA	NA	-	-	-	-	-	NA	NA
Croatia	NO	NO	NO	-	-	-	-	-	NA	NA
Cyprus	NA	NA	NA	-	-	-	-	-	NA	NA
Czechia	9 782	5 581	4 334	95.1%	-5 448	-56%	-1 246	-22%	CS,T2	CS,D,PS
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	NO	32	28	0.6%	28	∞	-4	-13%	T2,T3	CS,PS
Germany	NO	NO	NO	-	-	-	-	-	NA	NA
Greece	-	-	-	-	-	-	-	-	-	-
Hungary	-	-	-	-	-	-	-	-	-	-
Ireland	NA	NA	NA	-	-	-	-	-	NA	NA
Italy	NO	NO	NO	-	-	-	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	17	0	0	0.0%	-17	-100%	0	-6%	T2	D
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	1	NO	NO	-	-1	-100%	-	-	NA	NA
Poland	2 060	NO	NO	-	-2 060	-100%	-	-	NA,T2	CS
Portugal	NO	NO	NO	-	-	-	-	-	NO	NO
Romania	NO	NO	NO	-	-	-	-	-	NA	NA
Slovakia	18	10	4	0.1%	-14	-79%	-7	-64%	T2	PS
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	672	375	151	3.3%	-521	-78%	-224	-60%	T2	PS
Sweden	NA	NA	NA	-	-	-	-	-	NA	NA
EU-27	**12 584**	**6 038**	**4 558**	**100%**	**-8 027**	**-64%**	**-1 480**	**-25%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

As shown in the previous tables, several countries use the notation key "IE" for some subcategories. This can be explained by the fact that they apply carbon balances with several processes occuring within the same industrial plant, which makes differentiation into the various subcategories complex. For example, several countries include emissions from the production of pig iron (which occurs at integrated iron and steel production plants) under "steel production".

According to the 2006 IPCC guidelines, all emissions related to the use of solid fuels in iron and steel production (except eventual iron and steel gases sold to operators from other sectors) should be reported under category 2.C.1, irrespective of their role as reducing agent or fuel for energy use.

However, some countries report emissions from blast furnace gas and from basic oxygen furnace gas under 1A2a instead of 2C1 because this can be interpreted as emissions from energy supply.

Thus, for an overview of total emissions it seems to be more convenient to take into account all emissions covered by the combined category 1A2a + 2C1. Resulting emissions for this combined category are given in Table 4.24.

Table 4.24 CO_2 Emissions (2023) from iron and steel production: 1A2a, 2C1 and combined (sum of both categories). The column "Share 2C1" denotes the ratio of emissions under 2C1 and combined emissions.

Member State	CO_2 emissions in kt			Share in EU-27 emissions in 2023	Share 2C1
	1A2a	2C1	Combined		
Austria	1 715	10 188	11 903	10%	86%
Belgium	1 014	3 249	4 262	3%	76%
Bulgaria	112	12	124	0%	10%
Croatia	65	18	83	0%	22%
Cyprus	0	NA,NO	0	0%	-
Czech Republic	1 349	4 334	5 684	5%	76%
Denmark	77	NO	77	0%	-
Estonia	0	NO	0	0%	-
Finland	755	1 953	2 709	2%	72%
France	3 308	8 115	11 422	9%	71%
Germany	33 819	14 619	48 438	40%	30%
Greece	88	65	153	0%	43%
Hungary	56	297	353	0%	84%
Ireland	2	NA,NO	2	0%	-
Italy	9 099	1 324	10 423	9%	13%
Latvia	2	NO	2	0%	-
Lithuania	NO	0	0	0%	100%
Luxembourg	236	87	322	0%	27%
Malta	0	NO	0	0%	-
Netherlands	3 607	9	3 616	3%	0%
Poland	3 222	995	4 217	3%	24%
Portugal	100	61	162	0%	38%
Romania	548	1 243	1 791	1%	69%
Slovakia	2 633	3 734	6 367	5%	59%
Slovenia	168	44	212	0%	21%
Spain	4 369	1 656	6 025	5%	27%
Sweden	1 253	2 392	3 645	3%	66%
EU-27	**67598**	**54394**	**121992**	**100%**	**45%**

Note: Abbreviations are explained in the Chapter 'Units and abbreviations'.

It can be seen that the ratio of emissions under 2C1 and combined emissions (see column "Share 2C1" in Table 4.24) varies significantly across countries. This indicates that the boundary between 1A2a and 2C1 is not uniformly interpreted by countries. The ten countries with largest combined CO_2 emissions from iron and steel production allocate their emissions in the following ways in 2023:

- Germany: Around 30% of emissions are reported under 2C1. This category comprises process-related CO_2 emissions (including emissions from carbonate use). However, emissions from energy-related use of top gas and converter gas are reported under the respective sub-categories of sector 1.
- France: From the 2019 inventory onwards, France changed its methodology of estimating and allocating CO_2 emissions in the iron and steel sector sub-categories (process and combustion), to be more compliant with the 2006 IPCC Guidelines. While major share of emissions (84%) was reported under 1A2a in the 2018 inventory, 71% are allocated in 2C1 in 2023 in the most recent inventory. Emissions from sinter production are reported under 1A2a.

- Austria: 86% of emissions are reported under 2C1. Generally, all emissions from iron and steel production are reported under this category, irrespective of their role as reducing agent or fuel, but emissions related to the coke oven gas and to natural gas in on-site power plants are reported under category 1A2a.
- Italy: Major share of emissions (87%) is reported under 1A2a. CO_2 emissions due to the consumption of coke, coal and other reducing agents used in the iron and steel industry have been accounted for as fuel consumption and reported in the energy sector. In sector 2C1, emissions are reported from carbonates used in sinter plants and in basic oxygen furnaces, emissions related to steel and pig iron scraps and emissions from graphite electrodes consumed in electric arc furnaces.
- Czech Republic: 76% of emissions are reported under category 2C1. It also includes emissions from limestone and dolomite use.
- Spain: Major share of emissions (73%) is reported under 1A2a.
- Slovakia: 59% of emissions are reported in 2C1. Category iron and steel production includes following processes: steel production, pig iron production, sinter production and steel production in electric arc furnaces. Due to the difficult disaggregation between emissions originated from pig iron and from steel productions, total CO_2 emissions from total production processes were allocated directly in steel production category.
- Poland: 24% of CO_2 emissions are reported in 2C1, including steel production (basic oxygen furnaces and electric arc furnaces), pig iron production, sinter production.
- Belgium: 76% of CO_2 emissions are reported in 2C1, where all solid fuel consumptions in installations other than boilers (1A1a and 1A2a) and coke ovens (1A1c) are considered, in line with IPCC guidelines.

4.3.3.2 2C3 Aluminium production

Two PFCs, tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6), are known to be emitted from the process of primary aluminium smelting. These PFCs are formed during the phenomenon known as the anode effect, when the aluminium oxide concentration in the reduction cell electrolyte is low.

Information on CO_2 emissions from Aluminium production can be found at the end of this section.

Table 4.25 summarises information by countries on emission trends for the key source PFCs from category 2C3 Aluminium Production. PFC emissions from 2C3 Aluminium production are rather marginal in recent years, and account for 0.005 % of total EU GHG emissions (including indirect CO_2 and LULUCF, but without international aviation) in 2023. Between 1990 and 2023, PFC emissions from this source decreased by 99.2% (i.e., 17,102 kt CO_2e). In 2023, Greece contributed the highest share among the EU, amounting to 48.2% of overall GHG emissions, followed by Sweden (23.8%), France (15.3%) and Germany (11.6%). Of the seven countries reporting PFC emissions under this category in 2023, six use plant or country-specifc emission factors (Germany here is reported as NA due to problem reporting but applies a country-specific EF according to Annex IX).

Table 4.25 2C3 Aluminium Production: Countries' contributions to PFC emissions and information on method applied and emission factor

Member State	PFCs Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	1 032	NO	NO	-	-1 032	-100%	-	-	NA	NA
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	NO	NO	NO	-	-	-	-	-	NA	NA
Croatia	1 117	NO	NO	-	-1 117	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	NO	NO	NO	-	-	-	-	-	NA	NA
Denmark	-	-	-	-	-	-	-	-	NA	NA
Estonia	-	-	-	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	3 211	33	20	15.3%	-3 191	-99%	-12	-38%	T3	PS
Germany	2 597	35	15	11.6%	-2 581	-99%	-20	-56%	NA	NA
Greece	171	63	64	48.2%	-107	-63%	1	1%	NA,T3	NA,PS
Hungary	338	NO	NO	-	-338	-100%	-	-	NA	NA
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	1 778	NO	NO	-	-1 778	-100%	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	2 374	NO	NO	-	-2 374	-100%	-	-	NA	NA
Poland	127	NO	NO	-	-127	-100%	-	-	NA	NA
Portugal	NO	NO	NO	-	-	-	-	-	NO	NO
Romania	2 530	1	1	0.6%	-2 529	-100%	0	-36%	NA,T2	D,NA,PS
Slovakia	214	6	0	0.0%	-214	-100%	-6	-100%	NA,T1,T2	D,NA,PS
Slovenia	187	4	1	0.5%	-186	-100%	-3	-83%	NA,T3	D,NA,PS
Spain	1 046	1	NA,NO	-	-1 046	-100%	-1	-100%	NA	NA
Sweden	511	34	31	23.8%	-480	-94%	-3	-9%	T2	D
EU-27	**17 234**	**177**	**132**	**100%**	**-17 102**	**-99%**	**-45**	**-25%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

All countries reduced drastically their PFC emissions from this source between 1990 and 2023. France (-3,191 kt CO_2e, i.e., -99%), Germany (-2,581 kt CO_2e, i.e., -99%), Romania (-2,529 kt CO_2e, i.e., -100%), and the Netherlands (-2,374 kt CO_2e, i.e., -100%), had the largest decreases in absolute terms. The decreasing trend of PFC emissions from this key source between 1990 and 2023 is due to production stop or decline as well as to process improvements. The emission peak in 2002 (see Figure 4.12) can be explained by technological changes and sub-optimal conditions of operation (in France and in the Netherlands).

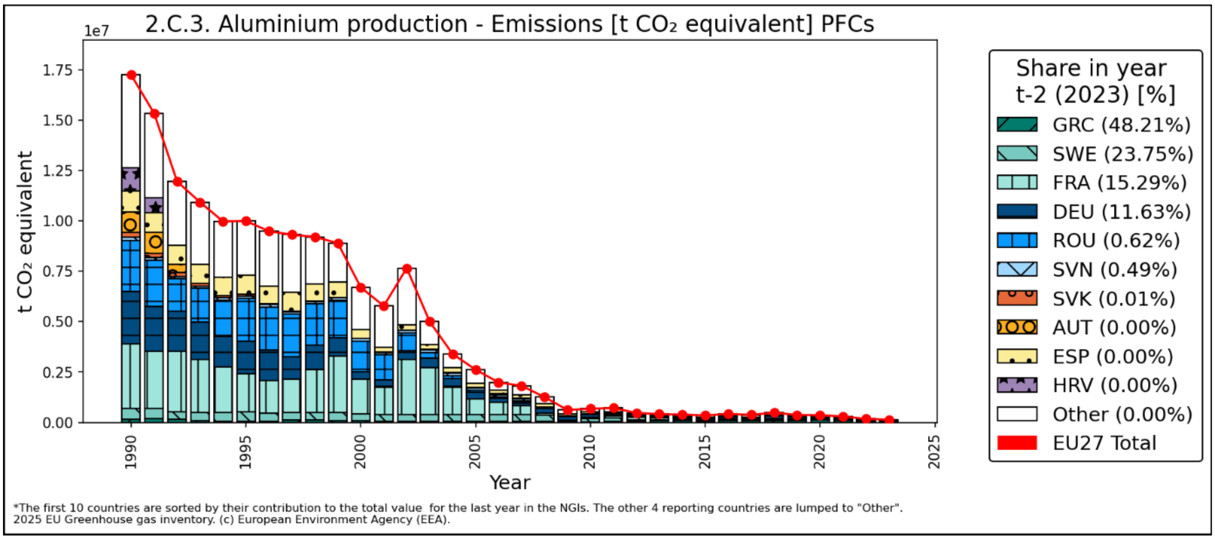
In the review of the 2014 inventory submission of the European Union, the ERT recommended that the European Union provides in the NIR adequate methodology overviews to enable the ERT to make a thorough review of the AD and EF used in the aluminium production emission estimations provided by Greece, the Netherlands and Sweden. This information is provided below. Additional information can be found in the individual NIDs (Greece: section 4.13, Netherlands: section 4.4, Sweden: section 4.3.3). An overview of methods can also be found in Annex III of this year's inventory submission.

Greece: The estimation of emissions from aluminium production is performed in close collaboration with the sole plant operating in Greece and since 2013 ETS verified reports are also provided to the inventory team. Carbon dioxide emissions from primary aluminium production are calculated using a highly detailed methodology, tracking the carbon content throughout the process. The methodology is based on the 2006 IPCC Tier 3 method, with small interventions that increase the certainty of the estimations. The equations are described in Greece's NID. Data are provided by the plant for years 2005-2012. Since detailed data for the previous years are not available, emissions of years 1990-2004 have been recalculated using the Overlap method in line with the 2006 IPCC Guidelines. It should be noted that the production methodology applied is Centre Worked Prebake with Feed Point System (PFPB methodology). Data since 2013 are provided by the verified ETS reports. Aluminium production data are directly provided by the plant and are considered confidential. However, publicly available data from the US Geological Survey, the UN Commodity Statistics Database and the Greek Mining Enterprises Association are also used for QA/QC reasons. According to the recommendation made by the previous ERTs, Greece is reporting aluminium production based on these data, although the estimations are based on the more detailed and accurate production quantities provided directly by the plant. It should be mentioned that the reported values are the ones provided by the US Geological Survey, since they cover the whole of the time-series. PFC emissions estimates are based on anode effect performance by calculating the anode effect overvoltage statistic (Overvoltage method) and are provided directly to the inventory team by the sole plant operating in Greece. This methodology concerns measurements and recordings that are being performed concerning the parameters of the equation used for the CF4 emission's calculation, namely the overvoltage and the aluminium production process current efficiency. The EF is estimated based on EF=Over-Voltage Coefficient*AEO/CE. The Over-Voltage Coefficient value used by the plant is 1.16 (the updated default one of 2006 IPCC Guidelines), while the Anode Effect Overvoltage (AEO) and Current Efficiency (CE) are measured for each series of electrolytic cells (there are three series).

The Netherlands: Estimations of the PFC emissions from primary aluminium production reported by these two facilities are based on the IPCC Tier 2 method for the complete period 1990–2017. Emission factors are plant-specific and confidential and are based on measured data. From emission year 2018 onwards, the emission data has been obtained from ETS reports.

Sweden: The two different processes for aluminium production, Prebake (CWPB) and Söderberg (VSS), have substantially different emission factors for PFCs. Estimates of emissions are based on the number of ovens and the number and duration of anode effects. This activity data is considered to be of good quality. Activity data used for the PFC emission calculations, anode effects in min/oven day and production statistics, were provided by the company, and specified for the Prebake and Söderberg technologies. The reported activity data and emissions can be found in Sweden's NID 2025.

Figure 4.12 2C3 Aluminium Production: PFC emissions



Besides PFC emissions, aluminium production is a source of CO_2 emissions. Of the eight countries which reported CO_2 emissions from aluminium production for 2023, two use a Tier 2 method and the six others use a Tier 3 method (France is in T3). One country uses the default emission factor, two use country-specific emission factors and six use plant-specifc emission factors (France is in PS)(Table 4.26). Information on activity data can be found in the CRT tables. Further details, e.g. on assumptions made by the various countries, can be found in the countries' NIDs.

Table 4.26 2C3 Aluminium Production: Countries' contributions to CO_2 emissions and information on method applied and emission factor

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	150	5	5	0.3%	-146	-97%	0	-6%	T3	PS
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	NO	NO	NO	-	-	-	-	-	NA	NA
Croatia	119	NO	NO	-	-119	-100%	-	-	NA	NA
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	NO	NO	NO	-	-	-	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	NO	NO	NO	-	-	-	-	-	NA	NA
France	534	622	605	41.6%	71	13%	-17	-3%	-	-
Germany	1 012	466	259	17.8%	-753	-74%	-207	-44%	T3	CS
Greece	225	302	299	20.6%	73	33%	-3	-1%	CS	CS
Hungary	128	NO	NO	-	-128	-100%	-	-	NA	NA
Ireland	NO	NO	NO	-	-	-	-	-	NA	NA
Italy	359	NO	NO	-	-359	-100%	-	-	NA	NA
Latvia	NO	NO	NO	-	-	-	-	-	NA	NA
Lithuania	NO	NO	NO	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	408	NO	NO	-	-408	-100%	-	-	NA	NA
Poland	78	NO	NO	-	-78	-100%	-	-	NA	NA
Portugal	NO	NO	NO	-	-	-	-	-	NO	NO
Romania	268	120	106	7.3%	-162	-60%	-13	-11%	T3	PS
Slovakia	121	111	7	0.5%	-114	-94%	-105	-94%	T3	PS
Slovenia	170	30	2	0.2%	-168	-99%	-28	-93%	T2	D,PS
Spain	610	9	NO	-	-610	-100%	-9	-100%	NA	NA
Sweden	133	175	171	11.8%	38	29%	-4	-2%	T3	PS
EU-27	**4 317**	**1 839**	**1 453**	**100%**	**-2 863**	**-66%**	**-386**	**-21%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

4.3.3.3 2C7 Other

Under this category, various emissions are reported which cannot be attributed to another category under 2C. Specifically, this includes the process emissions from the non-ferro sector (including lead and zinc) in Belgium, Silicium production in Spain, Copper and nickel smelting in Finland, emissions of CO_2 from one plant producing copper, lead and zinc, and one metal recycling plant mainly producing lead by melting used batteries and recovering the lead in Sweden, use of carbonates in grey iron in France, and CO_2 emissions from anode burn-off during the baking process of anodes (used for aluminium production) in Slovenia.

Information on the emissions from this category is given in the overview table in chapter 4.3.8.

4.3.4 Non-energy products from fuels and solvent use (CRT Source Category 2D)

This source category includes greenhouse gas emissions from non-energy products from fuel and solvent use. In 2023, this source category is not a key-category. However, this sector used to be a key category therefore this section is kept in the EU NID. Table.4.27 summarises information by countries on total GHG emissions. Between 1990 and 2023, GHG emissions from 2D non-energy products from fuels and solvent use decreased by 22.3%.

Table.4.27: 2D Non-energy products from fuels and solvent use: countries' contributions to total GHG, CO_2, N_2O- and CH_4 emissions

Member State	GHG emissions in kt CO2 equivalents		CO2 emissions in kt		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023	1990	2023
Austria	349	162	349	162	NA	NA	NA	NA
Belgium	202	123	202	123	NA,NO	NA	NA,NO	NA
Bulgaria	82	13	82	13	NA,NO	NA,NO	NA,NO	NA,NO
Croatia	192	64	192	64	NA,NO	NA	NA,NO	NA
Cyprus	4	5	4	5	NA,NE,NO	NA,NE	NA,NE,NO	NA,NE
Czechia	126	122	126	122	NA,NO	NA,NO	NA,NO	NA,NO
Denmark	72	102	71	101	0	0	0	1
Estonia	36	33	36	33	NO	NO	NO	NO
Finland	220	122	218	121	1	1	0	0
France	1 030	939	1 027	937	1	2	2	0
Germany	2 983	1 838	2 982	1 837	1	1	NA,NO	NA
Greece	129	71	129	71	NA,NO	NA,NO	NA,NO	NA,NO
Hungary	225	122	225	122	NA,NO	NA,NO	NA,NO	NA,NO
Ireland	96	115	96	115	NO	NO	NO	NO
Italy	370	313	370	313	NA,NO	NA,NO	NA,NO	NA,NO
Latvia	44	52	44	52	NA,NO	NA,NO	NA,NO	NA,NO
Lithuania	7	17	7	17	NO	NO	NO	NO
Luxembourg	19	24	19	24	NO	NO	NO	NO
Malta	4	6	4	6	NA,NO	NA	NA,NO	NA
Netherlands	188	381	187	381	NO	NO	0	0
Poland	213	311	213	311	NA,NO	NA,NO	NA,NO	NA,NO
Portugal	276	211	276	211	NA,NO	NA,NO	NA,NO	NA,NO
Romania	727	325	727	325	NA,NO	NA,NO	NA,NE,NO	NA,NE,NO
Slovakia	50	60	50	60	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
Slovenia	8	15	8	15	NA,NO	NA	NA,NO	NA
Spain	191	406	191	406	NA,NO	NA	NA,NO	NA
Sweden	180	283	180	283	NA	NA	NA	NA
EU-27	**8 021**	**6 235**	**8 015**	**6 230**	**3**	**4**	**3**	**2**

Abbreviations explained in the Chapter 'Units and abbreviations'.

4.3.4.1 2D1 Lubricant Use

CO_2 emissions from this sector amounted to approximately 0.06% of total GHG emissions in 2023. CO_2 emissions from this sector decreased by 38.4% since 1990.

4.3.4.2 2D3 Other non-energy products from fuels and solvent use

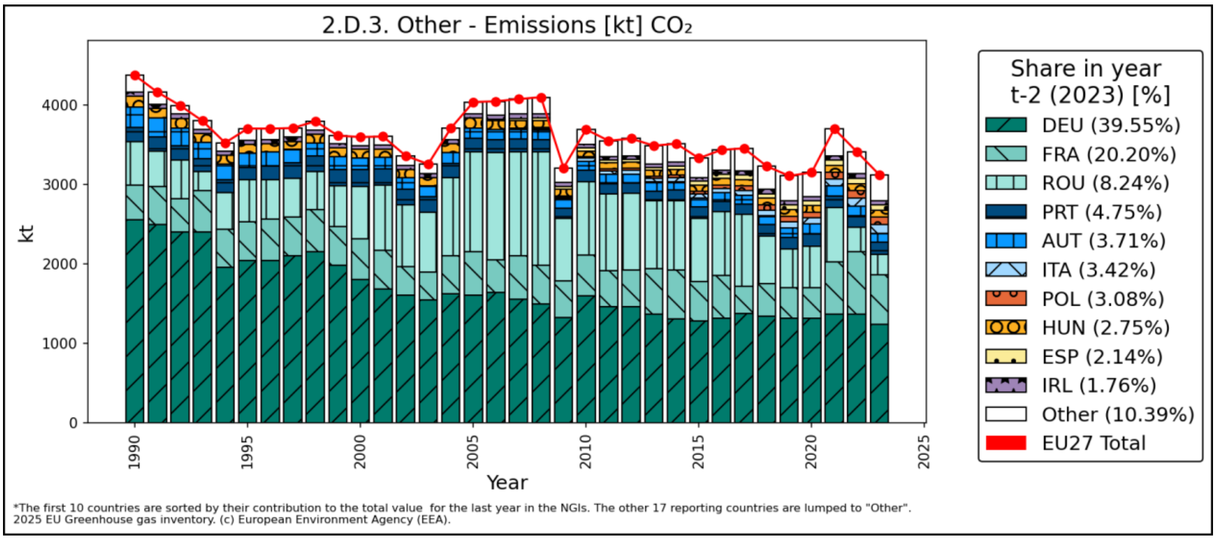
CO_2 emissions from this sector amounted to approximately 0.11 of total GHG emissions in 2023. CO_2 emissions decreased in 29% between 1990 and 2023. Some countries do not report emissions in this category for 1990, but report emissions, mainly from urea use in the transport sector, for more recent years.

Table 4.28: 2D3 Other non-energy products from fuels and solvent use: countries' contributions to CO_2 emissions

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	252	119	116	3.7%	-136	-54%	-3	-2%	NA,T2,T3	D,NA
Belgium	NA,NO	35	35	1.1%	35	∞	0	1%	M,NA,T3	CS,NA,OTH
Bulgaria	NA,NO	4	4	0.1%	4	∞	0	11%	NA,T2	D,NA
Croatia	151	41	40	1.3%	-111	-73%	-1	-2%	OTH,T1	D
Cyprus	NO	0	0	0.0%	0	∞	0	2%	-	-
Czechia	NA,NO	26	27	0.9%	27	∞	1	3%	NA,T2	D,NA
Denmark	NO	9	9	0.3%	9	∞	0	-5%	NA,T3	D,NA
Estonia	19	30	26	0.8%	7	39%	-4	-14%	T1,T2	D
Finland	NO	19	19	0.6%	19	∞	-1	-4%	NA,T1,T2	D,NA
France	438	792	630	20.2%	192	44%	-162	-21%	NA,T1,T2,T3	CS,D,NA,PS
Germany	2 551	1 361	1 233	39.5%	-1 318	-52%	-128	-9%	D	D
Greece	NA,NO	7	7	0.2%	7	∞	0	4%	D,NA	D,NA
Hungary	139	88	86	2.8%	-53	-38%	-2	-2%	T1,T2	D
Ireland	53	53	55	1.8%	2	3%	1	2%	T1,T2	D
Italy	NA,NO	103	107	3.4%	107	∞	4	4%	NA,T2	M,NA,PS
Latvia	21	27	32	1.0%	11	54%	5	18%	CS,D,T1,T2	D,PS
Lithuania	NO	2	2	0.1%	2	∞	0	4%	NA,T3	D,NA
Luxembourg	12	18	16	0.5%	4	30%	-2	-13%	CS,M	CS,D
Malta	0	1	1	0.0%	1	3586%	0	-8%	NA,T1	CR,D,NA
Netherlands	NO	35	36	1.2%	36	∞	1	4%	T3	CS
Poland	IE,NO	96	96	3.1%	96	∞	0	0%	NA,T3	D,NA
Portugal	180	146	148	4.8%	-31	-17%	2	1%	CR,T2	CR,CS,OTH
Romania	552	304	257	8.2%	-295	-53%	-47	-16%	CR,D,NA,OTH	R,CS,NA,OTH
Slovakia	NO	18	27	0.9%	27	∞	9	51%	CS,NA	CS,NA
Slovenia	NO	6	6	0.2%	6	∞	0	-6%	M	M
Spain	NA,NO	68	67	2.1%	67	∞	-2	-2%	CR,NA	CR,NA
Sweden	5	C	37	1.2%	32	676%	37	∞	T1,T3	CS,D
EU-27	**4 371**	**3 411**	**3 119**	**100%**	**-1 253**	**-29%**	**-292**	**-9%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 4.13 2D3 Other non-energy products from fuels and solvent use: CO_2 emissions



For this category, it is not useful to give an average EF across the countries because of the different methods used, and because of the fact that this category is split into many subcategories with varying EFs.

4.3.5 Electronics Industry (Category 2.E)

2.E Electronics Industry includes the following subcategories: 2.E.1 Integrated Circuit or Semiconductor, 2.E.2 TFT Flat Panel Display, 2.E.3 Photovoltaics, 2.E.4 Heat Transfer Fluid and 2.E.5 Other. Out of these, the most important emission source in Europe is the production of integrated circuits and semiconductors (2.E.1), which also represents a growing and strongly promoted industry sector. F-gases are used for plasma etching and wafer cleaning as well as cleaning of the chamber walls of thin-film deposition (TFD) and diffusion tools after processing substrates.

Emissions from photovoltaics industry and heat transfer fluids (HTFs) are reported by very few Member States only. Currently, there is no manufacture of TFT (thin-film transistors) flat panel displays in the EU.

The gases emitted include mainly F-gases with high global warming potentials (GWP) such as PFCs, SF_6 and NF_3 while HFC emissions occur to a relatively small extent only. Only in recent years, limited attempts have been made to reduce emissions through implementation and optimization of abatement measures as well as process optimization, however, replacements of high-GWP gases are hardly taking place.

Supply chain considerations as well as overall digitalization, particularly the large-scale introduction of electric vehicles, are expected to result in strengthening of the EU electronics industry and related increase of emissions in the coming years.

4.3.6 Product uses as substitutes for ODS (Category 2.F)

This emission source category describes the consumption of halocarbons (HFCs and PFCs) in different applications.

HFCs are predominantly serving as alternatives to ozone depleting substances (ODS) which are phased out under the Montreal Protocol. They were first introduced to the EU market at the end of 1990, their use increased strongly over the next two decades. Due to their high global warming potential, HFC emissions became significant with growing use. Therefore, HFCs are addressed by EU F-gas policy framework including the so-called MAC Directive, which bans the use of HFCs with a GWP >150 in new passenger cars since 2017, and the recently revised EU F-gas Regulation No. 2024/573. Measures of the latter regulation include restrictions of the bulk supply of HFCs on the EU market (the so called HFC phase out) which started in 2015 and refers to a stepwise reduction of placing on the market of HFCs in the EU which ultimately leads to a termination of use in 2050. This scheme resulted in an intended price increase for HFCs on the EU market, which pushes alternatives, particularly low GWP refrigerants and natural refrigerants. The regulation also entails bans for certain uses and restrictions for applications (with very few exceptions). Furthermore, it requires recovery and reclaim or destruction of used HFCs to reduce emissions from disposal. Other important measures of the F-gas Regulation refer to training of personnel, containment, labelling and reporting.

The main applications of halocarbons include refrigeration and air conditioning, foam blowing, fire protection, aerosols and solvents. PFCs are used to a minor extent in subcategory 2.F nowadays (see PFC column in table 1 below) but mainly in electronics industry (2.E).

The source category 2.F Product uses as substitutes for ODS includes two key categories which occur in all countries: Refrigeration and air conditioning (2.F.1) and aerosols (2.F.4, KC only with LULUCF), especially MDIs. The use of HFCs as foam blowing agents (2.F.2) and fire extinguishing agents (2.F.3) was common but decreased widely in recent years due to restrictions at EU level through the F-gas Regulation and national rules.

Table.4.29: Key categories for sector 2F (Table excerpt)

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
2.F.1. Refrigeration and air-conditioning: no classification (HFCs)	5	51247	T	0	L	100%

For 2.F Product uses as substitutes for ODS, Table 4.30 summarizes information by Member States on emission trends of total GHG emissions, HFCs and PFCs. SF_6 and NF_3 are not used in this subcategory. It should be noted that the amounts reported as “unspecified mix of HFCs and PFCs” are not shown in the table but also need to be considered in the total greenhouse gas emission estimates.

Table 4.30 2F Product uses as substitutes for ODS in 1990 and 2023: Member States and EU GHG emissions from this category and their split into HFC and PFC emissions

Member State	GHG emissions in kt CO2 equivalents		HFC emissions in kt CO2 equivalents		PFC emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
Austria	NO	1 400	NO	1 400	NO	0
Belgium	NO	1 900	NO	1 900	NO	NO
Bulgaria	NO	631	NO	631	NO	NO
Croatia	NO	1 929	NO	1 929	NO	NO
Cyprus	NE,NO	415	NE,NO	415	NO	NO
Czechia	NO	3 570	NO	3 570	NO	0
Denmark	NO	261	NO	261	NO	0
Estonia	NO	191	NO	191	-	-
Finland	0	695	0	694	NO	1
France	IE,NO	8 370	IE,NO	8 370	-	-
Germany	NA,IE,NO	7 298	IE,NA,NO	7 295	IE,NA,NO	4
Greece	NO	4 515	NO	4 492	NO	23
Hungary	0	1 700	0	1 698	NO	3
Ireland	NO	604	NO	604	NO	NO
Italy	NO	8 743	NO	8 724	NO	19
Latvia	NO	262	NO	262	NO	NO
Lithuania	NO	476	NO	476	NO	NO
Luxembourg	0	37	0	37	NO	NO
Malta	NE,IE,NO	200	IE,NE,NO	200	NO	0
Netherlands	NA,IE,NO	607	IE,NA,NO	607	NO	NO
Poland	NO	3 888	NO	3 878	NO	9
Portugal	NA,NO	1 979	NA,NO	1 944	NA,NO	34
Romania	0	1 980	0	1 980	NO	0
Slovakia	NO	438	NO	438	NO	NO
Slovenia	NO	297	NO	297	NO	NO
Spain	NA,NO	3 803	NA,NO	3 739	NO	0
Sweden	6	758	6	758	NO	NO
EU-27	**6**	**56 947**	**6**	**56 790**	**NA,IE,NO**	**93**

Abbreviations explained in the Chapter 'Units and abbreviations'. Spain also reports emissions of "unspecified mix of HFCs and PFCs" for 2.F.1.a Commercial refrigeration and 2.F.1.c Industrial refrigeration in 2023 (64 kt CO_2 eq)

F-gas emissions from 2.F Product uses as substitutes for ODS account for about 2% of total EU-27 GHG emissions (including LULUCF and direct emissions) in 2023. HFC emissions account for almost all of 2.F emissions (>99%) and were about 9500 times higher in 2023 than in 1990. The main reason for this is the phase-out of ODS such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and halons under the Montreal Protocol implemented by the EU ODS Regulation, and the replacement of these substances by HFCs in many applications such as refrigeration, air conditioning, foam production, fire protection and as aerosol propellants. Moreover, the refrigeration and air conditioning sector has grown significantly in Europe in the last decades.

Table.4.31 shows the sub-categories of HFC-gas emissions from 2.F Product uses as substitutes for ODS by country. It highlights that 2.F.1 Refrigeration and Air Conditioning is by far the largest sub-category accounting for approx. 90% (EU-27) of HFC emissions from this source category. While ODS were formerly widely used as aerosols and foam blowing agents, HFC emissions from subcategories

2.F.2 Foam blowing agents only contribute 2.2% in 2023, emissions from 2.F.3 Fire Protection account for 4.1% and emissions from 2.F.4 Aerosols/Metered Dose Inhalers range at 3%.

Table.4.31 2F Product uses as substitutes for ODS: Countries' sub-categories of HFC emissions (kt CO_2 equivalents) in 2023

Member State	**2.F Product uses as substitutes**	2.F.1 Refrigeration and air conditioning	2.F.2 Foam blowing agents	2.F.3 Fire protection	2.F.4 Aerosols	2.F.5 Solvents	2.F.6 Other applications
Austria	**1 400**	1 350	14	11	24	NO	-
Belgium	**1 900**	1 801	41	12	46	NO	NO
Bulgaria	**631**	609	NO	11	11	NO	NO
Croatia	**1 929**	1 899	15	6	9	NO	NO
Cyprus	**415**	401	1	9	3	NO	NO
Czech Republic	**3 570**	3 532	3	32	3	NO	NO
Denmark	**261**	249	0	-	12	-	-
Estonia	**191**	185	1	2	2	-	-
Finland	**694**	672	5	IE,NA,NO	17	NO	NO
France	**8 370**	7 609	153	26	550	32	IE,NO
Germany	**7 295**	6 578	252	91	373	IE,NO	NO
Greece	**4 492**	4 171	127	153	40	-	-
Hungary	**1 698**	1 547	100	20	30	NO	-
Ireland	**604**	516	NO	34	54	NO	NO
Italy	**8 724**	6 566	357	1 627	174	-	-
Latvia	**262**	256	0	0	5	NO	NO
Lithuania	**476**	448	15	4	9	NO	NO
Luxembourg	**37**	35	1	NO	1	NO	NO
Malta	**200**	197	2	1	0	NO	NO
Netherlands	**607**	460	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	146
Poland	**3 878**	3 729	65	83	1	0	-
Portugal	**1 944**	1 769	53	105	17	NO	NO
Romania	**1 980**	1 968	1	2	9	NO	NO
Slovakia	**438**	399	2	27	10	NO	-
Slovenia	**297**	290	1	0	5	NO	NO
Spain	**3 739**	3 275	34	67	364	NO	NO
Sweden	**758**	733	9	0	15	-	-
EU-27	**56 790**	**51 247**	**1 252**	**2 327**	**1 785**	**32**	**146**

Abbreviations explained in the Chapter 'Units and abbreviations'. Note: NLD reports HFC emissions from 2.F.2, 2.F.3, 2.F.4 and 2.F.5 in 2.F.6.

Table 4.32 shows the contribution of each country to EU-27 HFC emissions from 2.F.1 as well as information on the method applied, activity data and emission factor.

Table 4.32 2F1 Refrigeration and Air conditioning: Member States' contributions to HFC emissions and information on method applied, activity data and emission factor

Member State	HFCs Emissions in kt CO2 equiv.				Share in EU-27 Emissions in 2023	Change 1990-2023		Change 1995-2023		Change 2022-2023		Method	Emission factor Information
	1990	1995	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	NO	40	1 452	1 350	2.6%	1 350	∞	1 311	3317%	-101	-7%	NA,T2	CS,NA
Belgium	NO	87	2 022	1 801	3.5%	1 801	∞	1 714	1978%	-221	-11%	NA,T2	CS,D,NA,PS
Bulgaria	NO	3	653	609	1.2%	609	∞	606	20040%	-44	-7%	NA,T2	D,NA
Croatia	NO	21	1 781	1 899	3.7%	1 899	∞	1 877	8843%	118	7%	T2	CS,D
Cyprus	NO	28	381	401	0.8%	401	∞	373	1311%	20	5%	T2	D
Czechia	NO	87	3 586	3 532	6.9%	3 532	∞	3 445	3966%	-54	-1%	T2	CS
Denmark	NO	45	250	249	0.5%	249	∞	204	449%	-1	0%	NA,T2	D,NA
Estonia	NO	10	191	185	0.4%	185	∞	175	1817%	-5	-3%	T2	CS
Finland	0	146	738	672	1.3%	672	5723362%	526	360%	-66	-9%	T2	CS,D
France	NO	284	8 347	7 609	14.8%	7 609	∞	7 325	2580%	-738	-9%	T2	CS
Germany	NA,NO	546	6 738	6 578	12.8%	6 578	∞	6 032	1104%	-160	-2%	T2	CS,D
Greece	NO	40	4 195	4 171	8.1%	4 171	∞	4 131	10340%	-24	-1%	IE,T2	D,IE
Hungary	0	22	1 600	1 547	3.0%	1 547	71854862%	1 524	6790%	-53	-3%	T2	CS,D
Ireland	NO	5	535	516	1.0%	516	∞	512	11309%	-19	-4%	NA,T2,T3	CS,NA
Italy	NO	606	7 131	6 566	12.8%	6 566	∞	5 959	983%	-566	-8%	T2	CS,D
Latvia	NO	16	245	256	0.5%	256	∞	241	1519%	11	5%	T2	CS,D,OTH
Lithuania	NO	5	468	448	0.9%	448	∞	443	8260%	-19	-4%	T2	CS,D,PS
Luxembourg	0	3	37	35	0.1%	35	54242950%	32	1067%	-2	-5%	NA,T2	CS,M,NA,PS
Malta	NO	0	200	197	0.4%	197	∞	197	11471131%	-4	-2%	NA,T2	CS,NA
Netherlands	NO	44	478	460	0.9%	460	∞	417	955%	-18	-4%	CS,NA,T2	CS,NA
Poland	NO	16	4 131	3 729	7.3%	3 729	∞	3 713	23883%	-402	-10%	NA	NA
Portugal	NA,NO	28	1 705	1 769	3.5%	1 769	∞	1 741	6149%	64	4%	NO,T2	D,NO
Romania	NO	2	1 948	1 968	3.8%	1 968	∞	1 966	108570%	20	1%	T2	CS,D
Slovakia	NO	10	447	399	0.8%	399	∞	389	3810%	-48	-11%	T2	CS
Slovenia	NO	3	280	290	0.6%	290	∞	287	10597%	10	4%	T1,T2	CS,D
Spain	NA,NO	NA,NO	3 821	3 275	6.4%	3 275	∞	3 275	∞	-546	-14%	-	-
Sweden	5	122	791	733	1.4%	729	15675%	612	503%	-58	-7%	T2	CS,D
EU-27	**5**	**2 218**	**54 151**	**51 247**	**100%**	**51 242**	**1098959%**	**49 028**	**2210%**	**-2 905**	**-5%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

In 2023, HFC emissions from 2.F.1 enormously increased since 1990 (Table 4.32 and Figure 4.14 to Figure.4.17) but decreased by 5% compared to 2022 (EU) which is due to the measures of the EU F-gas Regulation.

France, Germany and Italy together were responsible for 40% of total EU emissions from this source in 2023.

Figure 4.14 2F1 Refrigeration and Air conditioning: EU HFC emissions

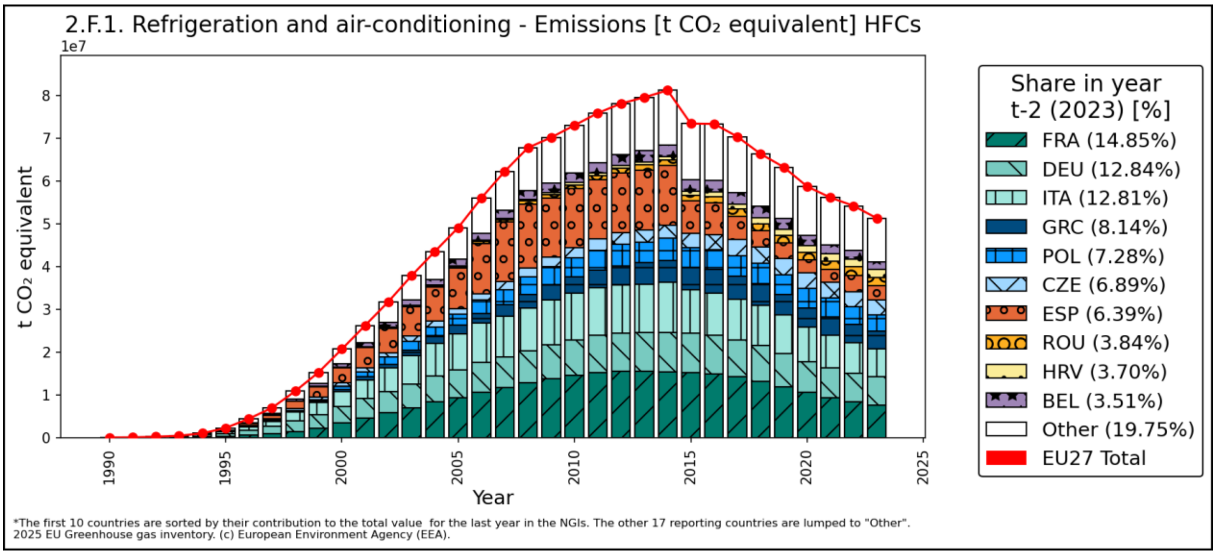


Figure 4.15 shows that emissions in sector 2.F.1 decreased again in 2023.

The main HFCs reported in this subcategory are HFC-32, HFC-125, HFC-134a and HFC-143a. They can be used as pure substances (such as HFC-32 and HFC-134a) and in mixtures (e.g. a refrigerant blend commonly used in stationary air conditioning is called “R410A” and is composed of 50% HFC-32 and 50% HFC-125).

Major developments in category 2.F.1 are driven by the subcategories 2.F.1.a Commercial refrigeration, 2.F.1.e Mobile air conditioning and 2.F.1.f Stationary air conditioning.

Emission plots for these prominent subcategories are provided in the following graphs. Please note that several Member States include in subcategory 2.F.1.a not only emissions from commercial refrigeration but also from industrial refrigeration and partly stationary air conditioning. After a peak in 2014, emissions from 2.F.1.a decreased steadily from 2015 onwards. This is in line with the policies and measures of the EU F-gas Regulation No. 2024/573 and preceeding F-gas regulations.

Figure 4.15 2F1a Commercial refrigeration: EU-27 HFC emissions

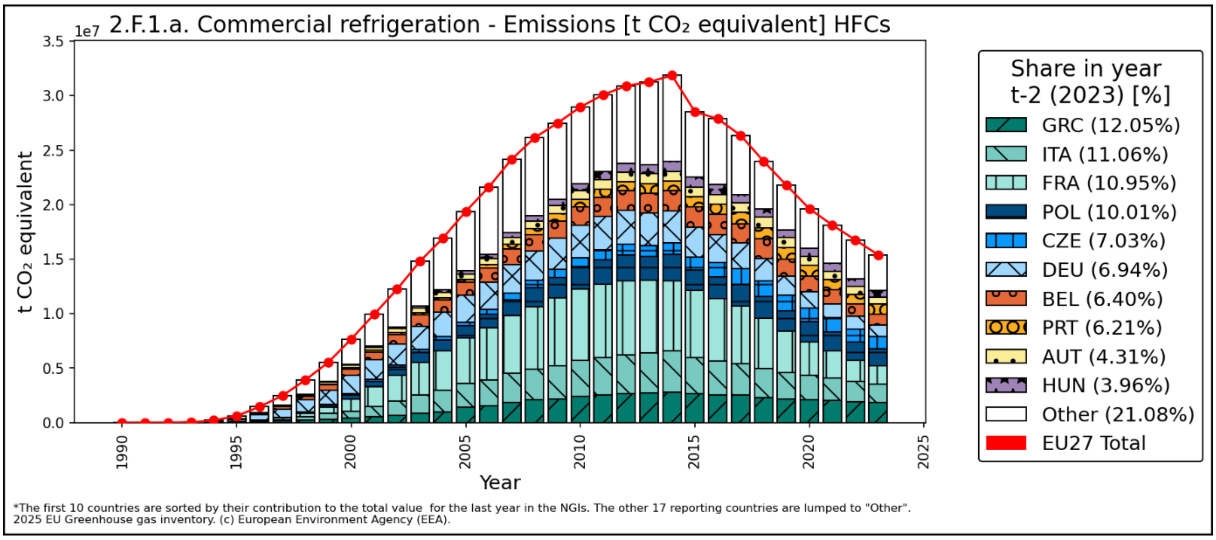


Figure.4.16: 2F1e Mobile air conditioning: EU-27 HFC emissions

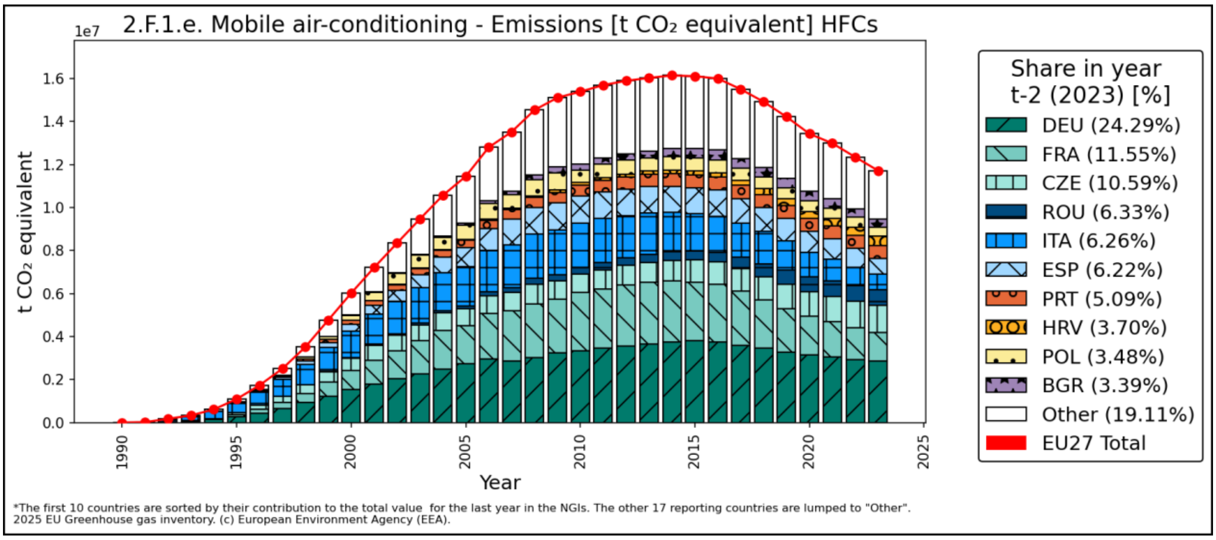


Figure.4.17 shows emission trends for mobile air-conditioning:

Emissions from 2.F.1.e decreased in all years from 2017 onwards. This relates to the introduction of the low-GWP refrigerants R1234yf and R744 in air-conditioning systems of new passenger cars.

Figure.4.17: 2F1f Stationary air conditioning: EU-27 HFC emissions

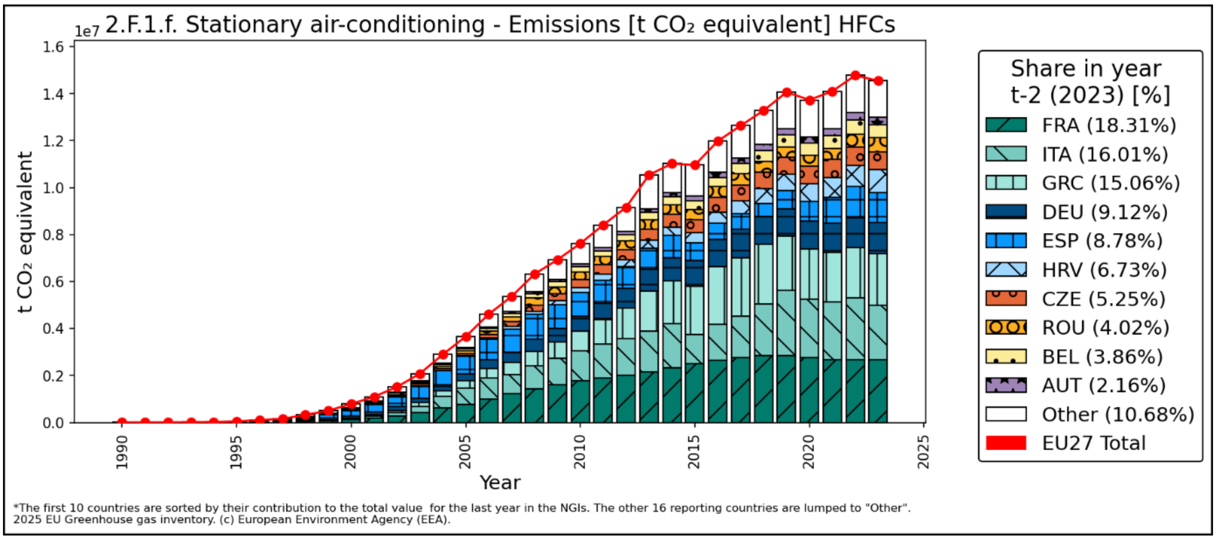


Figure.4.17 shows a constant increase for sector 2.F.1.f emissions until 2019. This development reflects the growing use of air conditioning equipment, particularly in Southern Europe, and the delayed uptake of alternatives to HFCs in this subcategory. Emissions in 2020 decreased slightly, which might be a consequence of the COVID-19 pandemic, when e.g. installations of new equipment were postponed. In 2021 and 2022, emissions from 2.F.1.f increased again due to continued growth of the sector but fell again in 2023, which might be due to the shift to refrigerants with low-GWP in certain product groups but also low numbers of heat pump installations in many EU Member States during that year.

Table.4.33 2F2 Foam Blowing: Countries' contributions to HFC emissions and information on method applied, activity data and emission factor

Member State	HFCs Emissions in kt CO2 equiv.				Share in EU-27 Emissions in 2023	Change 1990-2023		Change 1995-2023		Change 2022-2023		Method	Emission factor Information
	1990	1995	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	NO	275	14	14	1.1%	14	∞	-261	-95%	0	-1%	NA,T2	D,NA
Belgium	NO	324	69	41	3.2%	41	∞	-284	-87%	-28	-41%	NA,T2	CS,D,NA,PS
Bulgaria	NO	NO	NO	NO	-	-	-	-	-	-	-	NA	NA
Croatia	NO	NO	16	15	1.2%	15	∞	15	∞	-1	-5%	CS,NA	D,NA
Cyprus	NE,NO	NE,NO	1	1	0.1%	1	∞	1	∞	0	1%	CS,NA	CS,NA
Czechia	NO	0	2	3	0.2%	3	∞	3	20459%	0	17%	NA,T1	D,NA
Denmark	NO	192	1	0	0.0%	0	∞	-192	-100%	0	-16%	NA,T2	NA
Estonia	NO	17	2	1	0.1%	1	∞	-16	-94%	0	-33%	T2	CS
Finland	NO	0	4	5	0.4%	5	∞	5	998%	1	19%	NA,T2	D,NA
France	NO	NO	177	153	12.3%	153	∞	153	∞	-24	-13%	T2	CS
Germany	IE,NA,NO	1 533	324	252	20.1%	252	∞	-1 281	-84%	-73	-22%	NA,T2	CS,NA
Greece	NO	NO	170	127	10.1%	127	∞	127	∞	-43	-25%	NA,T2	D,NA
Hungary	NO	NO	137	100	8.0%	100	∞	100	∞	-37	-27%	NA,T2	CS,NA
Ireland	NO	NO	NO	NO	-	-	-	-	-	-	-	NA	NA
Italy	NO	NO	412	357	28.5%	357	∞	357	∞	-55	-13%	NA,T2	D,NA
Latvia	NO	0	1	0	0.0%	0	∞	0	-84%	-1	-95%	NA,T1a	D,NA,OTH
Lithuania	NO	NO	15	15	1.2%	15	∞	15	∞	0	0%	NA,T2	D,NA
Luxembourg	NO	9	1	1	0.1%	1	∞	-8	-89%	0	-8%	NA,T1	CS,NA
Malta	IE,NO	IE,NO	1	2	0.1%	2	∞	2	∞	0	11%	NA,T1	D,NA
Netherlands	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-	-	-	NA	NA
Poland	NO	NO	72	65	5.2%	65	∞	65	∞	-6	-9%	NA	NA
Portugal	NA,NO	1	52	53	4.2%	53	∞	52	6238%	1	2%	T2	D
Romania	NO	NO	1	1	0.0%	1	∞	1	∞	0	-5%	NA,T2	D,NA
Slovakia	NO	NO	2	2	0.1%	2	∞	2	∞	0	0%	NA,T3	D,NA
Slovenia	NO	27	1	1	0.1%	1	∞	-26	-96%	0	-5%	NA	NA
Spain	NO	NO	36	34	2.7%	34	∞	34	∞	-2	-6%	NA	NA
Sweden	NO	NO	10	9	0.7%	9	∞	9	∞	-1	-15%	T2	PS
EU-27	**NA,IE,NO**	**2 379**	**1 521**	**1 252**	**100%**	**1 252**	**∞**	**-1 128**	**-47%**	**-269**	**-18%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'. NLD reports HFC emissions from 2.F.2, 2.F.3, 2.F.4 and 2.F.5 in 2.F.6.

HFC emissions from 2.F.2 increased until 2008, dropped to a lower level from 2010 to 2017, declined steadily since 2017 and dropped again by 18% in 2023 compared to 2022 (Table.4.33 and Figure 4.18). This recent drop in emissions is due to changes of production processes as foam manufacturers converted their production to non-HFC blowing agents (usually hydrocarbons). The F-gas Regulation further limits the use of F-gases for this subcategory, as the placing on the market of foams containing HFCs with GWP of 150 or more has been banned from 2020 for extruded polystyrene (XPS) foams and for other foams from 2023, unless HFCs with higher GWPs are needed to meet national safety requirements.

Figure 4.18 2F2 Foam Blowing Agents: EU-27 HFC emissions

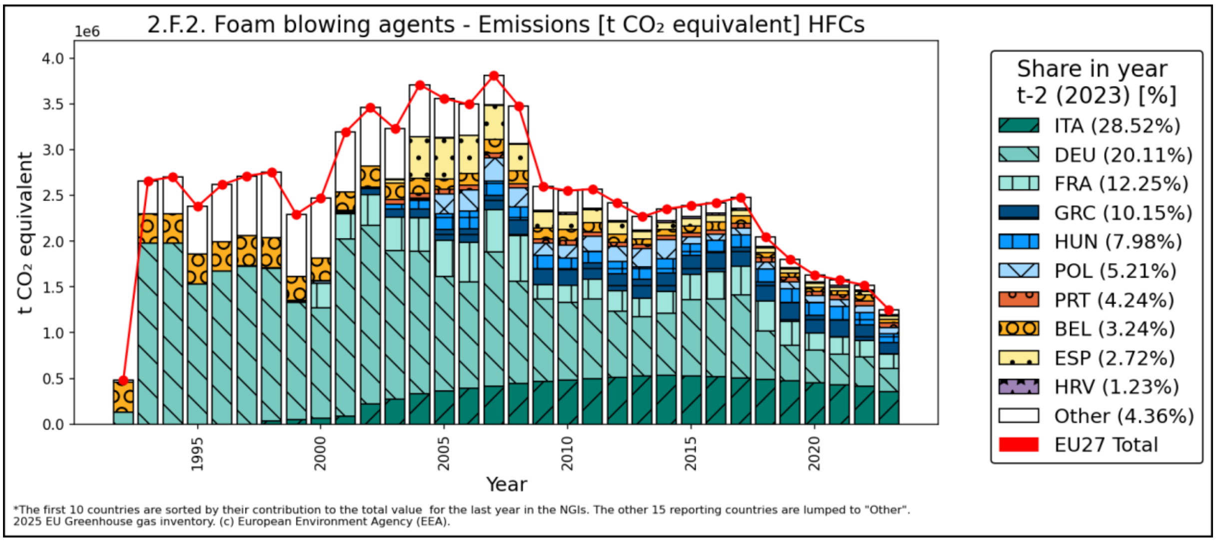


Table.4.34 2F3 Fire protection: Countries' contributions to HFC emissions and information on method applied, activity data and emission factor

Member State	HFCs Emissions in kt CO2 equiv.				Share in EU-27 Emissions in 2023	Change 1990-2023		Change 1995-2023		Change 2022-2023		Method	Emission factor Information
	1990	1995	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	NO	NO	11	11	0.5%	11	∞	11	∞	0	0%	T2	D
Belgium	NO	1	10	12	0.5%	12	∞	11	1864%	2	18%	T2	CS,D,PS
Bulgaria	NO	NO	13	11	0.5%	11	∞	11	∞	-2	-18%	T2	NA
Croatia	NO	0	6	6	0.2%	6	∞	5	2669%	0	-1%	T1,T2	D,PS
Cyprus	NE,NO	0	9	9	0.4%	9	∞	9	22744%	0	1%	CS	CS
Czechia	NO	NO	31	32	1.4%	32	∞	32	∞	1	3%	D	D
Denmark	-	-	-	-	-	-	-	-	-	-	-	NA	NA
Estonia	NO	NO	2	2	0.1%	2	∞	2	∞	0	5%	T2	CS
Finland	NO	NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-	-	-	NA	NA
France	NO	5	31	26	1.1%	26	∞	21	465%	-5	-16%	T1	CS
Germany	NA,NO	NA,NO	98	91	3.9%	91	∞	91	∞	-6	-6%	CS	CS,D
Greece	NO	NO	153	153	6.6%	153	∞	153	∞	0	0%	CS	D
Hungary	NO	NO	16	20	0.9%	20	∞	20	∞	5	29%	T1	D
Ireland	NO	NO	34	34	1.5%	34	∞	34	∞	0	0%	T2	CS
Italy	NO	16	1 641	1 627	69.9%	1 627	∞	1 611	10272%	-14	-1%	T2	CS
Latvia	NO	NO	0	0	0.0%	0	∞	0	∞	0	0%	T2	D
Lithuania	NO	NO	4	4	0.2%	4	∞	4	∞	0	4%	T1b	D
Luxembourg	NO	NO	NO	NO	-	-	-	-	-	-	-	NA	NA
Malta	NO	NO	1	1	0.0%	1	∞	1	∞	0	-5%	CS	D
Netherlands	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-	-	-	NA	NA
Poland	NO	NO	87	83	3.6%	83	∞	83	∞	-4	-4%	-	-
Portugal	NA,NO	NO	107	105	4.5%	105	∞	105	∞	-1	-1%	T2	D
Romania	NO	NO	3	2	0.1%	2	∞	2	∞	0	-5%	T2	D
Slovakia	NO	2	22	27	1.2%	27	∞	25	1148%	5	24%	T1a	CS
Slovenia	NO	NO	0	0	0.0%	0	∞	0	∞	0	-6%	T2	CS,D
Spain	NO	1	74	67	2.9%	67	∞	66	7864%	-6	-9%	-	-
Sweden	NO	NO	0	0	0.0%	0	∞	0	∞	0	-90%	T1	CS
EU-27	**NA,IE,NO**	**24**	**2 354**	**2 327**	**100%**	**2 327**	**∞**	**2 303**	**9525%**	**-27**	**-1%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.
NLD reports HFC emissions from 2.F.2, 2.F.3, 2.F.4 and 2.F.5 in 2.F.6.

HFC emissions from 2.F.3 (Table.4.34 and Figure 4.19) strongly increased from 1995 until 2017. This development was caused by the phase-out of ozone depleting substances, especially halons, as fire extinguishing agents under the Montreal Protocol and the subsequent introduction of HFCs and other ODS alternatives as replacements. Since 2017 emissions have been quite stable with a small decrease of 1% in 2023 compared to 2022. Emissions from this category arise on the one hand from assembly, leakage and decommissioning but also from releases in the case of fires and false alarms. The EU F-gas Regulation sets out bans for the placing on the market of new equipment using PFCs (since 2007), HFC-23 (since 2016) and all other HFCs (from 2025). Instead, other chemicals or not-in-kind alternatives, e.g. water mist, fluorinated ketones etc., have been introduced and applied for many years.

Figure 4.19 2F3 Fire Protection, EU-27: HFC emissions

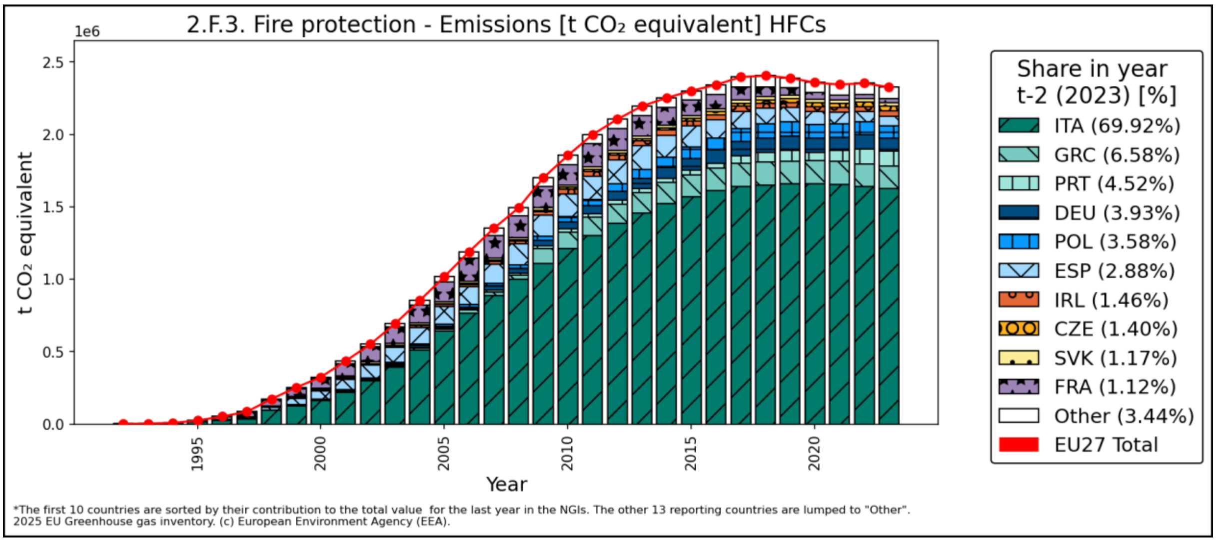


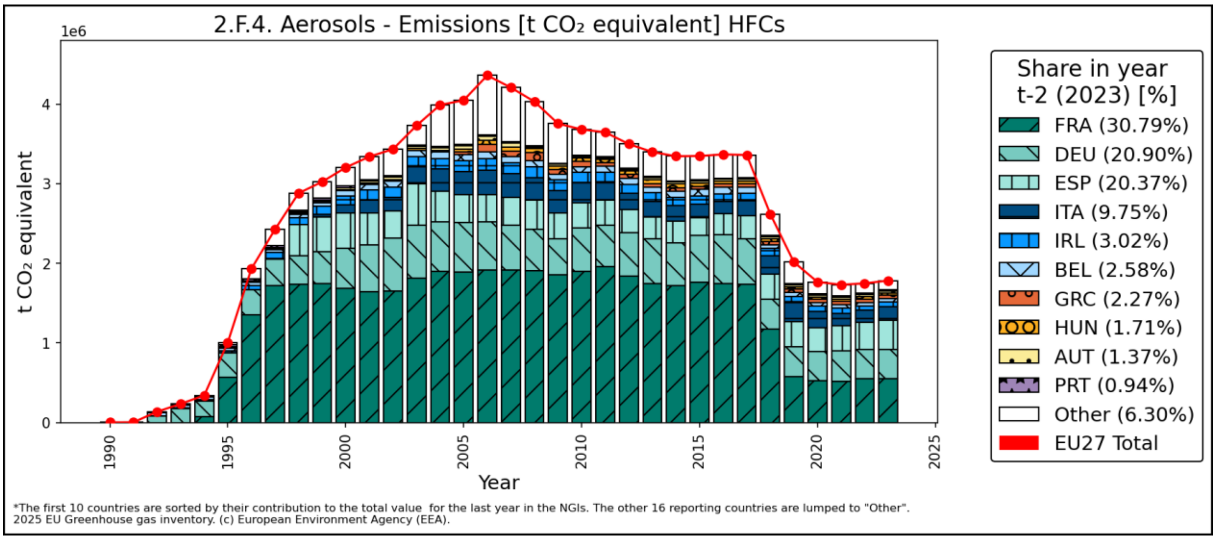
Table 4.35 2F4 Aerosols/ Metered Dose Inhalers: Countries' contributions to HFC emissions and information on method applied, activity data and emission factor

Member State	HFCs Emissions in kt CO2 equiv.				Share in EU-27 Emissions in 2023	Change 1990-2023		Change 1995-2023		Change 2022-2023		Method	Emission factor Information
	1990	1995	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	NO	4	27	24	1.4%	24	∞	20	498%	-2	-8%	T1,T2	D
Belgium	NO	38	46	46	2.6%	46	∞	8	22%	0	1%	NA,T2	CS,D,NA,PS
Bulgaria	NO	NO	10	11	0.6%	11	∞	11	∞	1	11%	NA	NA
Croatia	NO	NO	10	9	0.5%	9	∞	9	∞	0	-2%	NA,T1a	D,NA
Cyprus	NO	0	3	3	0.2%	3	∞	3	664906%	0	-1%	CS,NA	CS,NA
Czechia	NO	0	3	3	0.2%	3	∞	3	25585682%	0	8%	NA,T1	D,NA
Denmark	NO	NO	11	12	0.6%	12	∞	12	∞	1	7%	NA,T2	D,NA
Estonia	NO	0	3	2	0.1%	2	∞	2	4954%	-1	-18%	NA,T2	CS,NA
Finland	NO	2	17	17	0.9%	17	∞	15	698%	0	-1%	NA,T2	D,NA
France	NO	566	548	550	30.8%	550	∞	-16	-3%	1	0%	T2	CS
Germany	IE,NO	311	373	373	20.9%	373	∞	62	20%	0	0%	NA,T2	CS,NA
Greece	NO	0	41	40	2.3%	40	∞	40	138854%	0	0%	T2	D
Hungary	NO	11	31	30	1.7%	30	∞	20	187%	-1	-3%	T2	CS,D
Ireland	NO	25	53	54	3.0%	54	∞	29	116%	1	1%	T1,T2	CS
Italy	NO	NO	152	174	9.8%	174	∞	174	∞	22	14%	NA,T2	CS,NA
Latvia	NO	0	6	5	0.3%	5	∞	5	9363%	0	-7%	NA,T1a	D,NA
Lithuania	NO	1	9	9	0.5%	9	∞	8	1024%	0	1%	T1a	D
Luxembourg	NO	1	1	1	0.1%	1	∞	-1	-38%	0	2%	NA,T1,T2	CS,NA
Malta	NE,NO	NE,NO	1	0	0.0%	0	∞	0	∞	0	-31%	NA,T1	CS,NA
Netherlands	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-	-	-	NA	NA
Poland	NO	16	0	1	0.0%	1	∞	-15	-96%	0	94%	NA	NA
Portugal	NA,NO	25	17	17	0.9%	17	∞	-8	-31%	0	2%	NA,T2	NA,NO
Romania	0	1	21	9	0.5%	9	5525%	9	1315%	-12	-56%	NA,T2	D,NA
Slovakia	NO	NO	10	10	0.6%	10	∞	10	∞	0	2%	NA,T1a	D,NA
Slovenia	NO	NO	5	5	0.3%	5	∞	5	∞	0	1%	NA,T1	D,NA
Spain	NO	NO	340	364	20.4%	364	∞	364	∞	24	7%	NA	NA
Sweden	1	7	15	15	0.9%	14	1087%	9	132%	1	5%	T2	D
EU-27	**1**	**1 007**	**1 750**	**1 785**	**100%**	**1 784**	**121772%**	**778**	**77%**	**35**	**2%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.
NLD reports HFC emissions from 2.F.2, 2.F.3, 2.F.4 and 2.F.5 in 2.F.6.

HFC emissions from 2.F.4 peaked in 2006 following increased use of medical aerosols throughout Europe, especially for asthma treatment (metered-dose inhalers) (Table 4.35 and *Figure **4.20***). In the period from 2006 to 2012, emissions declined to a lower level and then remained rather stable until 2017. In 2018 and 2019, emissions from technical aerosols dropped as the EU F-gas Regulation banned the placing on the market of technical aerosols containing HFCs with GWP of 150 or more, except when required to meet national safety standards or for medical applications. From 2019 onwards, emissions from this subcategory have been ranging at stable levels.

Figure 4.20: 2F4 Aerosols/Metered Dose Inhalers: EU-27 HFC emissions



Only few companies are relevant in terms of HFC emissions from subcategories 2.F.5 Solvents and 2.F.6 Other applications, thus, for confidentiality reasons, MS report emissions together with other subcategories and no further details can be provided in this report.

4.3.7 Other product manufacture and use (Category 2G)

This category comprises PFC and SF_6 use in applications not covered by 2.E. and 2.F. 2.G. subcategories have been relevant for many decades now and will become increasingly relevant as HFC emissions decrease. SF_6 is a particularly potent greenhouse gas that is used predominantly in insulated switch gear for transportation and distribution of electric power (2.G.1). Emissions also occur from other product use (2.G.2), such as military applications (SF_6), particle accelerators (SF_6), applications of adiabatic properties - shoes and tyres (SF_6, PFCs), soundproof windows (SF_6), medical and cosmetic applications (SF_6, PFCs), other (SF_6, PFCs) etc.

Table 4.36 shows that all Member States report GHG emissions in 2.G Other product manufacture and use for the year 2023. SF_6 emissions from the subcategory electrical equipment (2.G.1) are reported by all Member States except the Netherlands where SF_6 emission estimates are included elsewhere. Emissions from accelerators are included by a growing number of Member States compared to previous years.

Table 4.36 2G Other: Overview of sources reported under this source category in 2023

Country	2.G Other product manufacture and use	HFC emissions [kt CO_2 equivalents]	PFC emissions [kt CO_2 equivalents]	SF_6 emissions [kt CO_2 equivalents]	NF_3 emissions [kt CO_2 equivalents]	Unspecified mix of HFCs and PFCs [kt CO_2 equivalents]	Total emissions [kt CO_2 equivalents]	Share in EU-KP Total
AUT	Electrical equipment (SF_6); Soundproof windows (SF_6); Other (SF_6)	NO	NO	357	-	-	398	6.4%
BEL	Electrical equipment (SF_6); Soundproof windows (SF_6); Other (C6F14)	NO	NO	89	NO	NO	130	2.1%
BGR	Electrical equipment (SF_6)	NO	NO	20	NO	-	52	0.8%
HRV	Electrical equipment (SF_6)	NO	NO	10	NO	NO	28	0.4%
CYP	Electrical equipment (SF_6)	NA,NO	NO	18	NO	NO	24	0.4%
CZE	Electrical equipment (SF_6); Accelerators (SF_6); Soundproof windows (SF_6); Other (SF_6)	NO	NO	72	-	NO	270	4.4%
DNK	Electrical equipment (SF_6); Soundproof windows (SF_6); Other (SF_6)	NO	NO	13	0	NO	33	0.5%
EST	Electrical equipment (SF_6); Accelerators (SF_6)	NO	NO	3	NO	NO	6	0.1%
FIN	Electrical equipment (SF_6)	NO	IE,NO	25	NO	NO	48	0.8%
FRA	Electrical equipment (SF_6); Accelerators (SF_6); Other (SF_6, Unspecified mix of PFCs)	1	162	304	-	-	601	9.7%
DEU	Electrical equipment (SF_6); Military applications (SF_6 => Notation Key C); Accelerators (SF_6); Soundproof windows (SF_6); Adiabatic properties: shoes and tyres (SF_6, C3F8 => Notation Key C); Other (SF_6 => partly Notation Key C, C10F18 => Notation Key C); 4. Other (HFC-134a, HFC-245fa => Notation Key C, HFC-365mfc => Notation Key C)	25	IE,NO	1637	NO	NO	1890	30.4 %
GRC	Electrical equipment (SF_6)	-	NO	5	-	-	214	3.4%
HUN	Electrical equipment (SF_6); Other (SF_6)	NO	NO	116	NO	NO	361	5.8%
IRL	Electrical equipment (SF_6); Soundproof windows (SF_6); Adiabatic properties: shoes and tyres (SF_6); Other (SF_6)	NA,NO	NA,NO	5	NA,NO	NO	47	0.8%

Country	2.G Other product manufacture and use	HFC emissions [kt CO_2 equivalents]	PFC emissions [kt CO_2 equivalents]	SF_6 emissions [kt CO_2 equivalents]	NF_3 emissions [kt CO_2 equivalents]	Unspecified mix of HFCs and PFCs [kt CO_2 equivalents]	Total emissions [kt CO_2 equivalents]	Share in EU-KP Total
ITA	Electrical equipment (SF_6); Accelerators (SF_6)	NO	NO	319	-	NO	790	12.7 %
LVA	Electrical equipment (SF_6)	NO	NO	12	NO	NO	16	0.3%
LTU	Electrical equipment (SF_6); Accelerators (SF_6)	NO	NO	1	NO	NO	4	0.1%
LUX	Electrical equipment (SF_6); Soundproof windows (SF_6), Other (HFC-43-10mee)	3	NO	9	NO	NO	17	0.3%
MLT	Electrical equipment (SF_6), Other (SF_6, C3F8)	NO	0	0	NO	NO	3	0.0%
NLD	Other (SF_6)	NO	NO	105	-	NO	212	3.4%
POL	Electrical equipment (SF_6)	NO	NO	116	NO	NO	237	3.8%
PRT	Electrical equipment (SF_6)	NO	NO	27	NO	NO	56	0.9%
ROU	Electrical equipment (SF_6)	NO	NO	56	NO	NO	58	0.9%
SVK	Electrical equipment (SF_6)	NO	NO	15	NO	NO	71	1.2%
SVN	Electrical equipment (SF_6)	NA,NO	NA,NO	17	NA,NO	NA,NO	68	1.1%
ESP	Electrical equipment (SF_6); Accelerators (SF_6), Other (SF_6)	NO	NO	247	NO	NO	471	7.6%
SWE	Electrical equipment (SF_6); Soundproof windows (SF_6)	-	NO	38	-	-	100	1.6%
EU-27	**TOTAL**	**29**	**162**	**3636**	**NA,NO**	**NA, NO**	**6207**	**100%**

Abbreviations explained in the Chapter ‘Units and abbreviations’.

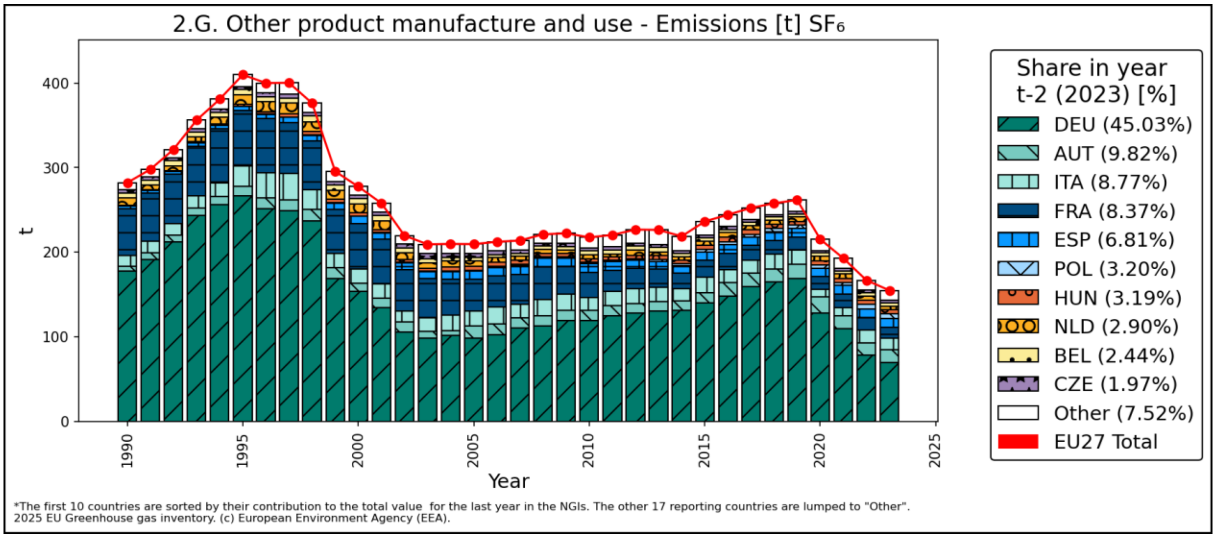
*Figure **4.21*** and Table.4.37 summarize information by Member State on SF_6 emissions for the key source 2.G. Emissions peaked in the mid 1990ies and have been relatively stable after that until 2002 and showing a small but rather steady increase in the period from 2014 to 2019. However, since 2020 emissions decreased considerably. The development of emissions from this category is dominated by the emission trend in Germany (30.4% of SF_6 emissions from EU-27 in 2024), where the disposal of sound-proof windows containing SF_6 represents a particularly high but decreasing emission source.

Table.4.37: 2G - Member States' contributions to SF_6 emissions

Member State	SF6 Emissions in kt CO2 equiv.				Share in EU-27 Emissions in 2023	Change 1990-2023		Change 1995-2023		Change 2022-2023		Method	Emission factor Information
	1990	1995	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	136	277	347	357	9.8%	221	163%	80	29%	9	3%	T2	D
Belgium	133	139	87	89	2.4%	-44	-33%	-50	-36%	1	2%	NA,T1,T2	D,NA
Bulgaria	4	5	24	20	0.5%	16	416%	15	289%	-4	-18%	NA,NO,T2	D,NA,NO
Croatia	11	12	10	10	0.3%	-1	-5%	-2	-16%	0	5%	NA,T2	CS,NA
Cyprus	3	6	18	18	0.5%	15	553%	12	201%	0	0%	NA,T1	D,NA
Czechia	87	91	75	72	2.0%	-15	-17%	-19	-21%	-4	-5%	D,NA,T1	D,NA
Denmark	8	73	13	13	0.3%	4	49%	-60	-83%	0	-4%	NA,T2,T3	D,NA
Estonia	NO	3	3	3	0.1%	3	∞	0	1%	0	2%	NA,T3	CS,NA
Finland	46	27	23	25	0.7%	-22	-47%	-3	-9%	2	8%	NA,T2	CS,NA
France	1 299	1 539	343	304	8.4%	-995	-77%	-1 235	-80%	-39	-11%	NA,T1,T2,T3	CS,D,NA,PS
Germany	4 174	6 259	1 832	1 637	45.0%	-2 537	-61%	-4 622	-74%	-195	-11%	CS,D,NA,T3	CS,D,NA
Greece	3	4	5	5	0.1%	2	67%	2	43%	0	0%	CS,NA	CS,NA
Hungary	18	58	110	116	3.2%	98	544%	58	100%	6	5%	NA,T1,T2	D,NA
Ireland	34	39	7	5	0.1%	-29	-85%	-34	-87%	-2	-26%	NA,T1	CS,D,NA
Italy	303	568	350	319	8.8%	15	5%	-249	-44%	-31	-9%	CS,NA,T2	CS,NA,PS
Latvia	NO	0	12	12	0.3%	12	∞	12	6796%	0	0%	NA,T1	D,NA
Lithuania	NO	0	1	1	0.0%	1	∞	1	1246%	0	5%	NA,T3	CS,NA
Luxembourg	1	1	9	9	0.2%	8	855%	7	503%	-1	-6%	D,NA,T1,T3	S,D,M,NA,PS
Malta	0	1	0	0	0.0%	0	2435%	-1	-81%	0	10%	D,NA	D,NA
Netherlands	213	264	125	105	2.9%	-108	-51%	-158	-60%	-20	-16%	CS,NA	CS,NA
Poland	NO	13	126	116	3.2%	116	∞	104	801%	-10	-8%	NA,T2	D,NA
Portugal	NA	14	26	27	0.7%	27	∞	13	87%	1	4%	NO,T1	NO
Romania	0	1	51	56	1.6%	56	11732%	56	6056%	6	11%	NA,T2	D,NA
Slovakia	0	10	15	15	0.4%	15	24327%	4	40%	-1	-4%	NA,T3	CS,NA
Slovenia	10	13	17	17	0.5%	7	65%	4	34%	0	0%	NA,T1,T2	CS,D,NA
Spain	66	103	250	247	6.8%	182	275%	145	141%	-2	-1%	NO,T2,T3	CS,D
Sweden	81	111	39	38	1.0%	-43	-53%	-73	-66%	-1	-2%	T2,T3	CS,PS
EU-27	**6 631**	**9 631**	**3 919**	**3 636**	**100%**	**-2 996**	**-45%**	**-5 995**	**-62%**	**-283**	**-7%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations.

Figure 4.21: 2G - Other Product Manufacture and Use: SF_6 Trend in the EU-27 in CO_2 equivalents



4.3.8 IPPU – non-key categories

Table 4.38 provides an overview on the role of non-key categories in the IPPU sector.

Table 4.38 Aggregated GHG emission from non-key categories in the IPPU sector

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 2. IPPU in 2025	Change 1990-2025		Change 2024-2025	
	1990	2024	2025		kt CO_2 equ.	%	kt CO_2 equ.	%
2.A.3. Glass production: no classification (CO_2)	3 845.2	3 921.2	3 537.1	1.11%	-308.1	-8%	-384.2	-10%
2.B.1. Ammonia Production: no classification (CH_4)	2.1	1.7	2.5	0.00%	0.5	23%	0.8	46%
2.B.1. Ammonia Production: no classification (N_2O)	0.3	0.4	0.3	0.00%	0.0	14%	0.0	-8%
2.B.10. Other: no classification (CH_4)	108.4	103.1	102.1	0.03%	-6.2	-6%	-1.0	-1%
2.B.10. Other: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.B.10. Other: no classification (N_2O)	745.7	483.3	437.8	0.14%	-308.0	-41%	-45.5	-9%
2.B.10. Other: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.B.10. Other: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.B.10. Other: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.B.10. Other: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.B.3. Adipic Acid Production: no classification (CO_2)	26.5	15.9	12.2	0.00%	-14.3	-54%	-3.7	-23%
2.B.4. Caprolactam, Glyoxal and Glyoxylic Acid Production: no classification (CO_2)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 2. IPPU in 2025	Change 1990-2025		Change 2024-2025	
	1990	2024	2025		kt CO_2 equ.	%	kt CO_2 equ.	%
2.B.4. Caprolactam, Glyoxal and Glyoxylic Acid Production: no classification (N_2O)	3 769.7	751.8	508.7	0.16%	-3 261.0	-87%	-243.1	-32%
2.B.5. Carbide Production: no classification (CH_4)	6.2	8.3	4.6	0.00%	-1.6	-26%	-3.6	-44%
2.B.5. Carbide Production: no classification (CO_2)	1 798.9	149.7	135.8	0.04%	-1 663.1	-92%	-13.9	-9%
2.B.6. Titanium Dioxide Production: no classification (CO_2)	21.5	127.0	87.1	0.03%	65.6	305%	-39.9	-31%
2.B.7. Soda Ash Production: no classification (CO_2)	1 966.0	1 702.5	1 527.0	0.48%	-438.9	-22%	-175.5	-10%
2.B.8. Petrochemical and Carbon Black Production: no classification (CH_4)	1 211.6	1 182.0	1 073.2	0.34%	-138.4	-11%	-108.9	-9%
2.B.9. Fluorochemical Production: no classification (NF_3)	0.0	0.9	0.0	0.00%	0.0	0%	-0.9	-100%
2.B.9. Fluorochemical Production: no classification (PFCs)	3 955.4	396.2	209.1	0.07%	-3 746.3	-95%	-187.1	-47%
2.B.9. Fluorochemical Production: no classification (SF_6)	1 784.7	118.4	70.3	0.02%	-1 714.4	-96%	-48.1	-41%
2.C.1. Iron and Steel Production: no classification (CH_4)	419.8	136.9	113.6	0.04%	-306.2	-73%	-23.3	-17%
2.C.2. Ferroalloys Production: no classification (CH_4)	28.7	15.1	11.6	0.00%	-17.0	-59%	-3.5	-23%
2.C.2. Ferroalloys Production: no classification (CO_2)	4 659.8	1 661.5	1 081.1	0.34%	-3 578.8	-77%	-580.4	-35%
2.C.3. Aluminium Production: no classification (CO_2)	4 316.6	1 839.0	1 453.1	0.46%	-2 863.4	-66%	-385.9	-21%
2.C.3. Aluminium Production: no classification (SF_6)	14.1	0.0	0.0	0.00%	-14.1	-100%	0.0	0%
2.C.4. Magnesium Production: no classification (CO_2)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.4. Magnesium Production: no classification (HFCs)	0.0	14.8	15.2	0.00%	15.2	100%	0.4	3%
2.C.4. Magnesium Production: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.4. Magnesium Production: no classification (SF_6)	474.7	99.3	85.7	0.03%	-389.0	-82%	-13.7	-14%
2.C.5. Lead Production: no classification (CO_2)	391.5	187.6	205.5	0.06%	-186.0	-48%	17.9	10%
2.C.6. Zinc Production: no classification (CO_2)	1 610.3	917.2	662.4	0.21%	-948.0	-59%	-254.8	-28%
2.C.7. Other: no classification (CH_4)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.7. Other: no classification (CO_2)	464.8	443.6	413.2	0.13%	-51.6	-11%	-30.3	-7%
2.C.7. Other: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.7. Other: no classification (N_2O)	24.5	11.9	13.4	0.00%	-11.2	-45%	1.5	13%
2.C.7. Other: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.7. Other: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.C.7. Other: no classification (SF_6)	742.7	4.1	2.0	0.00%	-740.7	-100%	-2.1	-52%

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 2. IPPU in 2025	Change 1990-2025		Change 2024-2025	
	1990	2024	2025		kt CO_2 equ.	%	kt CO_2 equ.	%
2.C.7. Other: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.D.1. Lubricant Use: no classification (CH_4)	2.0	0.4	0.4	0.00%	-1.6	-79%	0.0	-4%
2.D.1. Lubricant Use: no classification (CO_2)	3 013.8	1 862.3	1 856.3	0.58%	-1 157.5	-38%	-6.1	0%
2.D.1. Lubricant Use: no classification (N_2O)	2.7	2.9	2.7	0.00%	-0.1	-2%	-0.2	-7%
2.D.2. Paraffin Wax Use: no classification (CH_4)	0.2	0.5	0.5	0.00%	0.3	151%	0.0	1%
2.D.2. Paraffin Wax Use: no classification (CO_2)	630.1	1 226.3	1 008.7	0.32%	378.5	60%	-217.6	-18%
2.D.2. Paraffin Wax Use: no classification (N_2O)	0.7	1.6	1.2	0.00%	0.5	76%	-0.4	-25%
2.D.3. Other: no classification (CH_4)	0.3	0.5	0.7	0.00%	0.3	109%	0.1	20%
2.D.3. Other: no classification (CO_2)	4 371.5	3 410.7	3 118.8	0.98%	-1 252.7	-29%	-291.9	-9%
2.D.3. Other: no classification (N_2O)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.1. Integrated Circuit or Semiconductor: no classification (HFCs)	68.6	36.2	26.3	0.01%	-42.3	-62%	-9.9	-27%
2.E.1. Integrated Circuit or Semiconductor: no classification (NF_3)	21.9	78.1	81.0	0.03%	59.1	270%	2.9	4%
2.E.1. Integrated Circuit or Semiconductor: no classification (PFCs)	392.2	520.3	446.3	0.14%	54.0	14%	-74.0	-14%
2.E.1. Integrated Circuit or Semiconductor: no classification (SF_6)	245.0	196.5	193.6	0.06%	-51.5	-21%	-3.0	-2%
2.E.2. TFT Flat Panel Display: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.2. TFT Flat Panel Display: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.3. Photovoltaics: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.3. Photovoltaics: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.4. Heat Transfer Fluid: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.4. Heat Transfer Fluid: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.5. Other: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.5. Other: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.5. Other: no classification (PFCs)	0.0	0.0	0.5	0.00%	0.5	100%	0.5	100%
2.E.5. Other: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.E.5. Other: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.1. Refrigeration and air-conditioning: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 2. IPPU in 2025	Change 1990-2025		Change 2024-2025	
	1990	2024	2025		kt CO_2 equ.	%	kt CO_2 equ.	%
2.F.1. Refrigeration and air-conditioning: no classification (PFCs)	0.0	93.7	84.1	0.03%	84.1	100%	-9.6	-10%
2.F.1. Refrigeration and air-conditioning: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.1. Refrigeration and air-conditioning: no classification (Unspecified mix of HFCs and PFCs)	0.0	982.0	64.1	0.02%	64.1	100%	-917.9	-93%
2.F.2. Foam Blowing Agents: no classification (HFCs)	0.0	1 521.3	1 251.9	0.39%	1 251.9	100%	-269.4	-18%
2.F.2. Foam Blowing Agents: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.2. Foam Blowing Agents: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.2. Foam Blowing Agents: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.2. Foam Blowing Agents: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.3. Fire Protection: no classification (HFCs)	0.0	2 353.5	2 326.9	0.73%	2 326.9	100%	-26.6	-1%
2.F.3. Fire Protection: no classification (PFCs)	0.0	9.6	9.1	0.00%	9.1	100%	-0.5	-5%
2.F.4. Aerosols: no classification (HFCs)	1.5	1 749.8	1 785.1	0.56%	1 783.6	121772%	35.3	2%
2.F.4. Aerosols: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.4. Aerosols: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.4. Aerosols: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.4. Aerosols: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.5. Solvents: no classification (HFCs)	0.0	24.2	32.5	0.01%	32.5	100%	8.3	34%
2.F.5. Solvents: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.6. Other Applications: no classification (HFCs)	0.0	157.6	146.5	0.05%	146.5	100%	-11.2	-7%
2.F.6. Other Applications: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.6. Other Applications: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.6. Other Applications: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.F.6. Other Applications: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.G.1. Electrical Equipment: no classification (HFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.G.1. Electrical Equipment: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 2. IPPU in 2025	Change 1990-2025		Change 2024-2025	
	1990	2024	2025		kt CO_2 equ.	%	kt CO_2 equ.	%
2.G.1. Electrical Equipment: no classification (SF_6)	979.3	1 259.0	1 233.2	0.39%	253.9	26%	-25.8	-2%
2.G.2. SF_6 and PFCs from Other Product Use: no classification (PFCs)	205.9	223.1	161.6	0.05%	-44.3	-22%	-61.5	-28%
2.G.2. SF_6 and PFCs from Other Product Use: no classification (SF_6)	4 275.2	2 378.7	2 127.2	0.67%	-2 148.0	-50%	-251.5	-11%
2.G.3. N_2O from Product Uses: no classification (N_2O)	4 412.5	2 560.6	2 183.6	0.69%	-2 228.9	-51%	-377.0	-15%
2.G.4 Other: no classification (CH_4)	65.2	76.2	71.1	0.02%	5.9	9%	-5.1	-7%
2.G.4 Other: no classification (CO_2)	144.6	118.9	113.4	0.04%	-31.2	-22%	-5.6	-5%
2.G.4 Other: no classification (HFCs)	0.0	19.7	29.4	0.01%	29.4	100%	9.8	50%
2.G.4 Other: no classification (N_2O)	4.0	9.6	12.2	0.00%	8.2	204%	2.6	27%
2.G.4 Other: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.G.4 Other: no classification (PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.G.4 Other: no classification (SF_6)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.G.4 Other: no classification (Unspecified mix of HFCs and PFCs)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.H Other: no classification (CH_4)	6.8	9.7	9.3	0.00%	2.5	36%	-0.5	-5%
2.H Other: no classification (CO_2)	113.1	127.4	119.5	0.04%	6.4	6%	-7.9	-6%
2.H Other: no classification (HFCs)	0.0	3.7	4.1	0.00%	4.1	47444 %	0.4	11%
2.H Other: no classification (N_2O)	56.7	80.4	76.4	0.02%	19.7	35%	-4.0	-5%
2.H Other: no classification (NF_3)	0.0	0.0	0.0	0.00%	0.0	0%	0.0	0%
2.H Other: no classification (PFCs)	0.2	0.9	1.0	0.00%	0.8	400%	0.1	6%
2.H Other: no classification (SF_6)	7.7	5.0	4.3	0.00%	-3	-45%	-0.8	-15%
2.H Other: no classification (Unspecified mix of HFCs and PFCs)	289.9	94.8	63.4	0.02%	-227	-78%	-31.4	-33%

4.4 Methodological issues and uncertainties

4.4.1 Methodological issues

The previous section presented for each EU key source in Sector 2 an overview of the Member States' contributions to the key source in terms of level and trend, information on methodologies, emission factors and completeness. Detailed information on national methods and circumstances is available in the Member States' national inventory reports.

4.4.2 Gap filling of Activity data

It is important to explain the reasons why the EU is not always able to provide EU-level AD or IEFs but has instead opted to transparently document what the MS have reported (see MS NIDs).

Countries use different in methodological approaches to calculate emissions. In some cases, a calculation of EU-level implied emission factors, based on a number of countries, is performed. In those cases where (a) more than 75% of the emissions are calculated on basis of consistent activity data, and (b) the IEF has a reasonable degree of consistency (i.e. standard deviation divided by mean < 50%) we gap-filled activity data in the CRT. In these cases we are confident that the IEF included in the CRT provides reliable information to reviewers and adds to the transparency of the EU inventory. In all other cases we believe that an IEF in the CRT would be misleading because it would be based on a limited number of countries or based on very different methodological approaches which cannot be meaningfully aggregated. Due to the significant amount of time required, the CRT only includes gap filled activity data for 2023 and only for the EU key categories where the criteria above apply. In 2025 the following categories have been gap-filled:

- Clinker production in 2.A.1
- Lime production in 2.A.2
- Ammonia Production in 2.B.1
- Nitric Acid Production in 2.B.2

The method for gap filling includes four steps:

1. Emissions have been aggregated for those MS that are using the same activity data and that are reporting activity data and emissions (i.e. not using notation keys for either activity data or emissions. Usually the geographical coverage of these MS is smaller than EU.
2. These emissions have been divided by the aggregated activity data of those MS in order to derive an IEF for those MS.
3. The total emissions of the EU have been divided by this IEF in order to derive a gap-filled estimate for activity data for EU.

Table **4.39** shows the results for the gap filling of activity data for the four categories.

Table 4.39 Documentation of gap filling of activity data

Category	**2023**			
	Activity data Description	**(kt)**	**IEF (t/t)**	**Emissions (kt)**
2A1	Clinker production	119 882	0.51	61 198
2A2	Lime Production	19 307	0.74	14 275
2B1	Ammonia Production	9 862	1.40	13 813
2B2	Nitric Acid Production	13 314	0.12	1 534

4.4.3 Uncertainty estimates

Table 4.40 shows the total EU uncertainty estimates for the sector 'Industrial processes' and the uncertainty estimates for the relevant gases of each source category. The highest level uncertainty was estimated for PFCs from 2.F (154 %) and the lowest for CO_2 from 2.A (3.3 %). With regard to trend, HFC from 2.F shows the highest uncertainty estimates, CO_2 from 2.A the lowest.

Table 4.40 Sector 2 Industrial processes: Uncertainty estimates for the EU

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
2.A Mineral Industry	CO_2	134 074	88 414	-34.06%	3.36%	0.92%
2.A Mineral Industry	CH_4	0	0	0.00%	0.00%	0.00%
2.A Mineral Industry	N_2O	0	0	0.00%	0.00%	0.00%
2.B Chemical Industry	CO_2	58 209	43 208	-25.77%	6.96%	1.27%
2.B Chemical Industry	CH_4	1 166	1 081	-7.29%	27.62%	8.78%
2.B Chemical Industry	N_2O	76 310	2 306	-96.98%	12.90%	3.67%
2.B Chemical Industry	HFC	10 262	102	-99.00%	10.57%	10.07%
2.B Chemical Industry	PFC	3 955	209	-94.71%	41.77%	10.45%
2.B Chemical Industry	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.B Chemical Industry	SF_6	1 785	70	-96.06%	42.43%	22.63%
2.B Chemical Industry	NF_3	0	0	0.00%	0.00%	0.00%
2.C Metal Industry	CO_2	114 930	58 210	-49.35%	5.36%	1.60%
2.C Metal Industry	CH_4	416	109	-73.87%	65.53%	5.63%
2.C Metal Industry	N_2O	25	13	-45.48%	69.52%	30.86%
2.C Metal Industry	HFC	0	15	Inf	24.90%	Inf
2.C Metal Industry	PFC	13 530	131	-99.03%	4.47%	9.83%
2.C Metal Industry	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.C Metal Industry	SF_6	1 046	4	-99.59%	14.66%	21.63%
2.C Metal Industry	NF_3	0	0	0.00%	0.00%	0.00%
2.D Non-energy products from fuels and solvent use	CO_2	7 821	5 818	-25.61%	35.29%	14.81%
2.D Non-energy products from fuels and solvent use	CH_4	3	2	-38.15%	58.91%	58.70%
2.D Non-energy products from fuels and solvent use	N_2O	3	4	13.02%	72.47%	31.77%
2.E Electronics industry	CO_2	0	0	0.00%	0.00%	0.00%
2.E Electronics industry	CH_4	0	0	0.00%	0.00%	0.00%
2.E Electronics industry	N_2O	0	0	0.00%	0.00%	0.00%
2.E Electronics industry	HFC	68	23	-66.66%	10.94%	34.07%
2.E Electronics industry	PFC	392	353	-9.92%	8.68%	13.62%

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
2.E Electronics industry	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.E Electronics industry	SF_6	245	164	-32.93%	13.31%	65.45%
2.E Electronics industry	NF_3	22	70	222.35%	13.56%	25.06%
2.F Product uses as substitutes for ODS	CO_2	0	0	0.00%	0.00%	0.00%
2.F Product uses as substitutes for ODS	CH_4	0	0	0.00%	0.00%	0.00%
2.F Product uses as substitutes for ODS	N_2O	0	0	0.00%	0.00%	0.00%
2.F Product uses as substitutes for ODS	HFC	6	41 445	694968.95%	33.80%	153467.62%
2.F Product uses as substitutes for ODS	PFC	0	28	Inf	154.25%	Inf
2.F Product uses as substitutes for ODS	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.F Product uses as substitutes for ODS	SF_6	0	0	0.00%	0.00%	0.00%
2.F Product uses as substitutes for ODS	NF_3	0	0	0.00%	0.00%	0.00%
2.G Other product manufacture and use	CO_2	145	113	-21.59%	11.54%	2.72%
2.G Other product manufacture and use	CH_4	65	71	9.09%	37.16%	8.23%
2.G Other product manufacture and use	N_2O	2 305	1 763	-23.50%	9.93%	2.68%
2.G Other product manufacture and use	HFC	0	26	Inf	19.43%	Inf
2.G Other product manufacture and use	PFC	206	162	-21.51%	22.36%	4.81%
2.G Other product manufacture and use	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.G Other product manufacture and use	SF_6	2 345	1 527	-34.86%	33.40%	16.60%
2.G Other product manufacture and use	NF_3	0	0	0.00%	0.00%	0.00%
2.H Other	CO_2	92	55	-40.11%	6.41%	4.06%
2.H Other	CH_4	7	9	36.08%	21.22%	7.66%
2.H Other	N_2O	57	76	34.95%	21.09%	7.37%
2.H Other	HFC	0	4	45181.53%	60.19%	27196.51%
2.H Other	PFC	0	1	400.14%	60.04%	240.26%
2.H Other	Unspecified mix of HFCs and PFCs	0	0	0.00%	0.00%	0.00%
2.H Other	SF_6	8	4	-44.59%	64.34%	28.69%
2.H Other	NF_3	0	0	0.00%	0.00%	0.00%
2 (where no subsector data were submitted)	*all*	20 863	19 190	-8.02%	25.65%	18.63%
Total - 2	**all**	**450 359**	**264 784**	**-41.21%**	**8.39%**	**2.40%**

Note: *Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories*

4.5 Sector-specific quality assurance and quality control

There are several arrangements for improving the quality of GHG emissions in the IPPU sector: (1) Before and during the compilation of the EU GHG inventory, several checks are made of the Member States data in particular for time series consistency of emissions and implied emission factors, comparisons of implied emission factors across countries and checks of internal consistency. Table 3.127 (in the Energy chapter), summarizes the main checks carried out on Member States' submissions.

Specifically for subsector 2.C, activity data in iron and steel production are compared with data from the World Steel association. Additional focus is put on the introduction of alternatives to F-gases in the quality checks of Member States' submissions. This is relevant in the context of the HFC phase-down under the EU F-gas Regulation.

Internal reviews are carried out in the time period between the inventory submission and the start of the next inventory preparation cycle. In 2022 a review was carried out for all significant issues identified during the checking phase, with a focus on the year 2020 in order to track progress of the EU Member States under the EU Effort Sharing Decision. The next internal review of the GHG inventories of all Member States is scheduled for June 2025.

4.6 Sector-specific recalculations

Recalculations are described in chapter 10, including the explanations for significant changes (>1000 kt CO_2eq) in categories.

4.7 Sector-specific improvements

In 2024, the reporting has been amended to be in line with the new CRT reporting tables, as well as the NID outline. Descriptions of categories have been aligned accordingly. Information across sectors has been streamlined to provide a harmonised approach across the whole NID. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

Continuing improvements include efforts to ensure consistency between CRT/JSON files and NID, and the provision of sufficient information to meet transparency requirements.

5 AGRICULTURE (CRT SECTOR 3)

Half the European Union's land is farmed. This fact alone highlights the importance of farming for the EU's natural environment. Farming and nature exercise a profound influence over each other. Farming has contributed over the centuries to creating and maintaining a variety of valuable semi-natural habitats. Today these shape the majority of the EU's landscapes and are home to many of the EU's richest wildlife. Farming also supports a diverse rural community that is not only a fundamental asset of European culture, but also plays an essential role in maintaining the environment in a healthy state[26].

The links between the richness of the natural environment and farming practices are complex. While many valuable habitats in Europe are maintained by extensive farming, and a wide range of wild species rely on this for their survival, agricultural practices can also have an adverse impact on natural resources. Pollution of soil, water and air, fragmentation of habitats and loss of wildlife can be the result of inappropriate agricultural practices and land use.

Agriculture in Europe is determined by the Common Agricultural Policy (CAP) of the European Union. The CAP dates from 1957, and its foundations are entrenched in the Treaty of Rome. Initially, the emphasis of the CAP was to increase agricultural productivity, partly for food security reasons, but also to ensure that the EU had a viable agricultural sector and that consumers had a stable supply of affordable food (Gay et al., 2005). With the MacSharry reform of 1992 several steps were taken by the EU to shift CAP subsidies away from price and market support towards direct support for farmers. This was further pursued with the Agenda 2000 reform, as signified by the shift in focus towards the maintenance and enhancement of the rural environment and the growing recognition of agriculture as a multifunctional activity. In environmental terms, the focus is on less-favoured areas and areas with environmental restrictions, and on agricultural production methods designed to protect the environment and to maintain the countryside.

However, price support and income payments, together with milk quotas, remained the dominant support measures. The 2003 CAP reform made further progress in the direction initiated by the Agenda 2000 reform, by aiming to make European agriculture more market oriented and giving a stronger focus to environmental protection. With the CAP reform, cross-compliance became an obligatory element of the CAP. Cross compliance links direct payments to respecting a number of statutory management requirements and to maintain all agricultural land in good agricultural and environmental conditions (EC 2003)[27].

- "Statutory management requirements" (SMR, Annex III of Regulation (EC) No 1782/2003) which are set in 19 community legislative acts on environment, food safety, animal health and welfare.
- The obligation to maintaining land in good agricultural and environmental conditions (GAECs) and maintaining permanent pasture at level at 1.5.2004. Definitions of GAEC are specified at national or regional level and should warrant appropriate soil protection, ensure a minimum level of maintenance of soil organic matter and soil structure and avoid the deterioration of habitats.

In 2013, the Council of the EU Agriculture Ministers adopted four Basic Regulations for a reformed CAP following a CAP Health Check[28] in 2008 and a Commission Communication on the CAP towards 2020[29] in

26 http://ec.europa.eu/agriculture/envir/index_en.htm

27 http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32003R1782

28 http://ec.europa.eu/agriculture/healthcheck/index_en.htm

29 https://ec.europa.eu/agriculture/cap-post-2013_en

2011. The four legislative texts that regulate the post-2013 CAP are (i) Rural Development: Regulation 1305/2013[30]; (ii) "Horizontal" issues such as funding and controls: Regulation 1306/2013[31]; (iii) Direct payments for farmers: Regulation 1307/2013[32]; (iv) Market measures: Regulation 1308/2013[33].

With the adoption of the 2013 CAP reform, the environment concerns received an enhanced focus being materialised by explicitly linking the agricultural support to "agricultural practices beneficial to the climate and environment" (so called 'CAP greening'). Agro-environmental indicators have been identified as useful tools to perform this task, especially since they allow for the assessment of territorial impacts. The monitoring and evaluation of CAP performance is carried out through indicators (EC 2006[34], 2001[35], 2000[36]). Green direct payments account for 30 % of EU countries' direct payment budgets. Farmers receiving an area-based payment have to make use of various straightforward, non-contractual practices that benefit the environment and the climate. These require action each year. They include:

- diversifying crops;
- maintaining permanent grassland; and
- dedicating 5 % of arable land to ecologically beneficial elements ('ecological focus areas').

The CAP 2023-27 entered into force on 1 January 2023. Support for farmers and rural stakeholders across the 27 EU countries is based on the CAP 2023-27 legal framework and the choices detailed in the national CAP Strategic Plans, approved by the Commission. Each EU country elaborated its own CAP Strategic Plan, including the anticipated intervention strategies, and the CAP instruments each EU country will use from 2023 to 2027 to achieve the CAP objectives. The approved Plans are designed to make a significant contribution to the ambitions of the European Green Deal, Farm to Fork Strategy and Biodiversity Strategy.

The **Nitrates Directive** (Council Directive 91/676/EEC) is the SMR with the largest impact on greenhouse gas emissions from agriculture. The directive aims at reducing and preventing water pollution caused by nitrates from agricultural sources with the goal that nitrate concentrations in groundwater will not exceed 50 mg NO_3^- l^{-1} and listing codes of good practice (Annex II A) to be implemented by the farmers on a voluntary basis. Nitrate vulnerable zones (NVZ) must be designated on the basis of monitoring results which indicate that the groundwater and surface waters in these zones are or could be affected by nitrate pollution from agriculture. The action program must contain mandatory measures relating to: (i) periods when application of animal manure and fertilizers are prohibited; (ii) capacity of and facilities for storage of animal manure; and (iii) limits to the amounts of animal manure and fertilizers applied to land.

The action programmes need to be implemented by farmers within NVZs on a compulsory basis. These programmes must include measures already included in Codes of Good Agricultural Practice, which

[30] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0487:0548:en:PDF

[31] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0549:0607:en:PDF

[32] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0608:0670:en:PDF

[33] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0671:0854:en:PDF

[34] EC (2006). Development of agri-environmental indicators for monitoring the integration of environmental concerns into the common agricultural policy. Communication from the Commission to the Council and the European Parliament. COM (2006) 508 final. Commission of the European Communities, Brussels.

[35] EC (2001). Statistical Information needed for Indicators to monitor the Integration of Environmental concerns into the Common Agricultural Policy. Communication from the Commission to the Council and the European Parliament. COM (2001) 144 final. Commission of the European Communities.

[36] EC (2000). Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy. Commission of the European Communities.

become mandatory, and other measures, such as limitation of fertilizer application (mineral and organic), taking into account crop needs and all nitrogen inputs and soil nitrogen supply, with maximum amount of livestock manure to be applied. Every four years countries are required to report on nitrates concentrations in groundwaters and surface waters; eutrophication of surface waters; assessment of the impact of action programme(s) on water quality and agricultural practices; revision of NVZs and action programme(s); estimation of future trends in water quality. This has affected NH_3 and N_2O emissions in most countries.

Beside the environmentally-targeted directives, also the first pillar of the CAP (dealing with market support in contrast to pillar two covering rural development measures) had a strong impact on the greenhouse gas emissions from agriculture in Europe, namely through the milk quota system, which lead to a strong reduction of animal numbers in the dairy sector to compensate for the increasing animal performance during the last decades. The milk quota system ended in 2015.

Other important policies affecting greenhouse gas emissions from agriculture, particularly by addressing the abatement of air pollution through the control of NO_x and NH_3 emissions include, amongst others:

- The 1999 Gothenburg Protocol under the Convention on Long Range Transboundary Air Pollution (CLRTAP[37]) to 'Abate Acidification, Eutrophication and Ground-level Ozone', revised in 2012 setting national emission reduction commitments to be achieved by 2020 and beyond;
- The National Emission Ceilings Directive (NEC - Directive 2016/2284/EC[38]) sets upper limits for each country for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution. It has been updated in 2016[39] setting new objectives for EU air policy for 2020 and 2030;
- The Industrial Emission Directive (IED[40][41]), which was established in 1996, and aims at minimizing pollution from point sources, i. e., intensive animal production facilities (pig and poultry farms, with more than 2000 fattening pigs (over 30 kg); more than 750 sows or more than 40,000 head of poultry). These are required under the directive to apply control techniques for preventing NH_3 emissions according to Best Available Technology (BAT). In April 2022, the Commission proposed to revise the former Industrial Emissions Directive to modernize it and make it more efficient in line with the European Green Deal objectives of zero pollution, climate neutrality and resource efficiency. This updated Directive entered in force on 2024. Member States will have 22 months to transpose the revised IED.

Legislation related with animal health may also affect emissions through changes in specific parameters. That is the case of Spain, where CH_4 emissions from enteric fermentation from swine decreased, partly due to the ban of the use of growth-promoting antibiotics in animal feeding that resulted in a radical change in feeding conditions.

Structural changes are caused also by the general development of countries. For example, in Finland, the membership in the EU resulted in changes in the economic structure followed by an increase in the average farm size and a decrease in the number of small farms (Pipatti, 2001), causing also a decrease in the livestock numbers for most animal types.

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37 http://www.unece.org/env/lrtap/multi_h1.html

38 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1554903780611&uri=CELEX:32016L2284

39 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L2284&from=EN

40 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075

41 http://ec.europa.eu/environment/industry/stationary/index.htm

5.1 Overview of sector

In the year 2023, CH_4, N_2O and CO_2 emissions from CRT sector 3 Agriculture were 56.9 %, 72.0 %, and 0.41 % of total CH_4, N_2O and CO_2 EU emissions, respectively. Total emissions from agriculture were 365 Mt CO_2-eq with contributions from CH_4, N_2O, and CO_2 of 229 Mt CO_2-eq, 127 Mt CO_2-eq and 9 Mt CO_2-eq, respectively.

Figure 5.1 shows the development of total GHG emissions from agriculture from 490 Mt CO_2-eq in 1990 to 365 Mt CO_2-eq in 2023. The reduction of emissions in absolute was most pronounced for CH_4 with a decrease of 73 Mt CO_2-eq, followed by N_2O and CO_2 with respectively a decrease of 47 Mt CO_2-eq and 5 Mt CO_2-eq. The cut was most pronounced before 2010 with a total reduction of 22 % between 1990 and 2010, followed by a rather stable period (2010-2021) and a further decrease by 4 % between 2021 and 2023.

The largest reductions occurred in CH_4 emissions from enteric fermentation and direct N_2O from agricultural soils, mainly because of the decreasing use of fertilizer and manure and declining cattle numbers in most countries.

Figure 5.1 EU GHG emissions for 1990-2023 from CRT Sector 3: 'Agriculture' in CO_2 equivalents (kt)

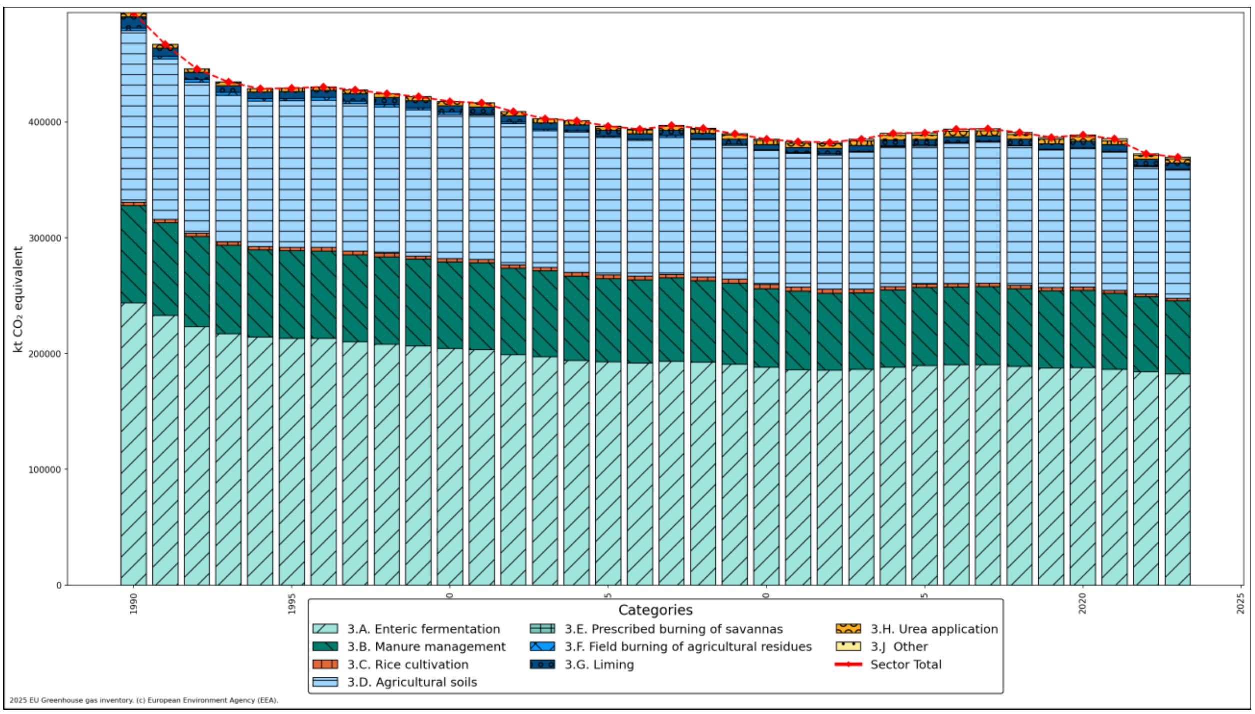


Table 5.1 Sector 3 Agriculture: Share of major categories and all remaining categories in 2023 for EU

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
3.A.2 - Enteric Fermentation - Sheep - CH4	23179	15442	-8	-33%	4%
All other agriculture categories	32165	24293	-8	-24%	7%
3.B.2 - N2O and NMVOC Emissions - Farming - N2O	27241	17643	-10	-35%	5%
3.D.2 - Agricultural Soils - Farming - N2O	33008	22366	-11	-32%	6%
3.B.1 - Farming - CH4	55973	44941	-11	-20%	12%
3.D.1 - Agricultural Soils - Direct N2O Emissions From Managed Soils - N2O	113209	86551	-27	-24%	24%
3.A.1 - Enteric Fermentation - Cattle - CH4	204739	153699	-51	-25%	42%
Total Agriculture	**489514**	**364936**	**-125**	**-25%**	**100%**

5.2 Overview of emission trends

In this section we analyze the contribution of the different emission categories to the overall trend of emissions from the EU agricultural sector. Table 5.2 shows the different emission categories, their contribution to total emissions in the EU sector and their contribution to the trend 1990-2023 and 2022-2023. A negative share of the trend means that the emissions in that category are evolving in the opposite direction to those of the EU.

Total emissions from agriculture have decreased by 25 % compared to 1990, and 49 % of this reduction is due to sector 3.A. Another important sector in determining long-term emission trends is 3.D.1 which accounts for 21 % of the total decrease in agricultural emissions, followed by 3.B-CH_4 (8.9 %), 3.D.2 (8.5 %) and 3.B-N_2O (7.7 %), while all the other categories contribute less. The decrease in emissions is mainly due to the decrease in the cattle population and the decrease in the quantities applied of fertilizers, both synthetic and organic.

Table 5.2 Contribution of the different emission categories to the total trend in emissions from the agricultural sector, compared to the share of emissions of those categories from the total of the sector

Emission category	Gas	Contribution to total agricultural emissions (2023)	Share of trend 1990-2023	Share of trend 2022-2023
3.A	CH_4	49%	49%	73%
3.B	CH_4	12%	9%	49%
3.B	N_2O	5%	8%	8%
3.C	CH_4	1%	1%	1%
3.D.1	N_2O	24%	21%	-24%
3.D.2	N_2O	6%	9%	-11%
3.F	CH_4	0.2%	1%	3%
3.F	N_2O	0.05%	0.2%	1%
3.G	CO_2	1.4%	3%	12%
3.H	CO_2	1.0%	0.1%	-12%
3.I	CO_2	0.2%	0.4%	1%
3.J	CH_4	0.4%	-1%	0%
3.J	N_2O	0.03%	-0.1%	0%

For the whole sector, there was a very slight decrease of emissions between 2022 and 2023 (0.7 % of total emissions). The main contributor to the total decrease in agricultural emissions from last year is category 3.A (73 % of the total trend), followed by 3.B CH_4 (21 %) and 3.G (12 %). Some categories show an opposite trend (increased emissions) : 3.D.1, 3.D.2, 3H.

5.3 Source categories and methodological issues

In this section, we present the information relevant for EU key source categories in the sector 3 Agriculture.

The data presented in Table 5.3 shows emissions from key categories in the base year and in the last reported year, whether they are identified as key due to the level or to the trend in emissions and the share of emissions in the category which are calculated using a Tier 2 or Tier 3 method or using country specific emission factors.

CH_4 emissions from enteric fermentation – mainly from cattle - are usually calculated with sophisticated methods. For indirect N_2O emissions from managed soils, the implementation of higher tier is more complex, a lot of countries are still using Tier 1 method. For CO_2 emissions from liming, all Member States are using a Tier 1 method.

Table 5.3 Key categories for the EU (Agriculture - sector excerpt). Emissions in kt CO_2 eq.

Source category gas	kt CO_2 equ.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
3.A. Enteric fermentation (CH_4)	240658	179484	T	L	L	100%
3.B. Manure management (CH_4)	55973	44941	T	L	L	100%
3.B. Manure management (N_2O)	27241	17643	0	L	L	98.1%
3.D.1. Direct N_2O emissions from managed soils (N_2O)	113209	86551	T	L	L	87%
3.D.2. Indirect N_2O emissions from managed soils (N_2O)	33008	22366	0	L	L	63.9%
3.G.1. Limestone $CaCO_3$ (CO_2)	6702	4639	0	0	L	0%

Other source categories are not identified as key sources in the analysis at EU level and are therefore not further discussed here. Emissions from source category J - other agriculture emissions are reported only from Germany (digestion of energy crops).

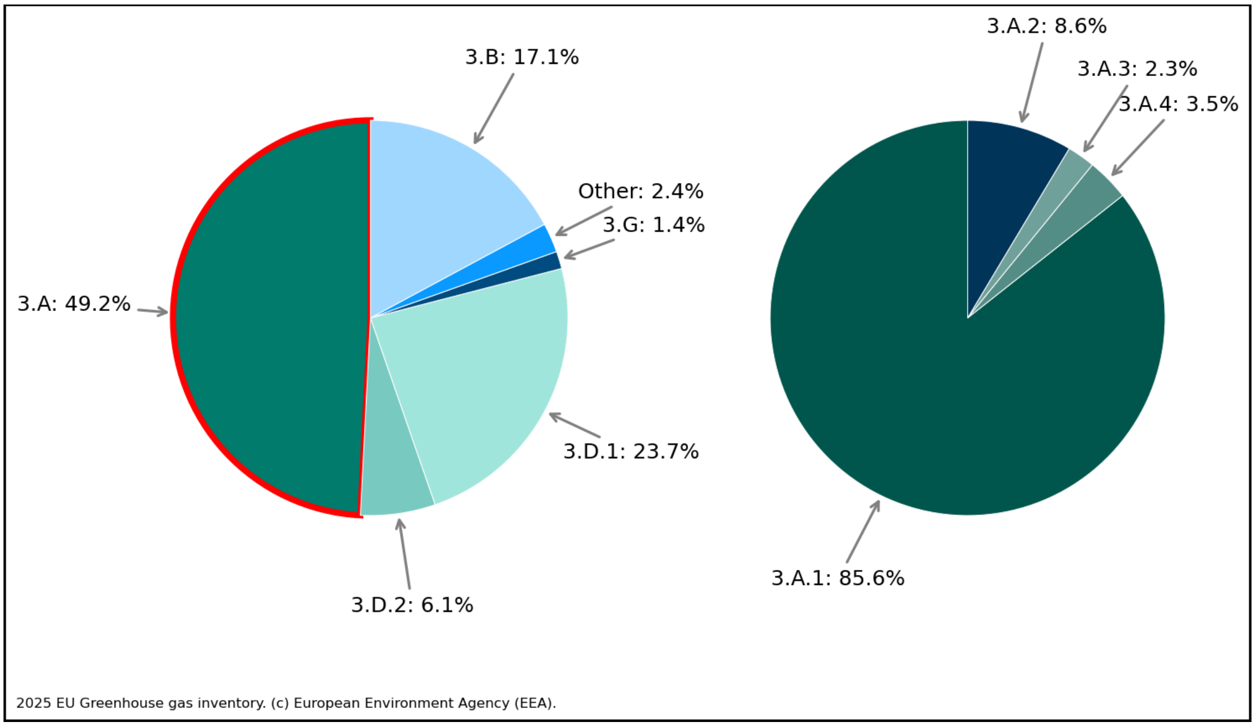
Many countries recognize that in the agriculture sector emissions from the different categories are inherently linked and are best estimated in a comprehensive model that covers not only greenhouse gases (CH_4 and N_2O) in a consistent manner, but also ammonia. Estimations of ammonia emissions are required for reporting under the Convention on Long-Range Transboundary Air Pollution and are needed to estimate indirect N_2O emissions. Hence, several countries have developed comprehensive models covering consistently different source categories and different gases.

5.3.1 Enteric fermentation (CRT Source Category 3.A)

In 2023 CH_4 emissions in source category *3.A - Enteric Fermentation* in the EU were 179 484 kt CO_2 equivalent. This corresponds to 6.2 % of total EU GHG emissions and 44.6 % of total EU CH_4 emissions. They make 49.2 % of total agricultural emissions and 78.4 % of total agricultural CH_4 emissions. It is thus the largest GHG source in agriculture and the largest source of CH_4 emissions.

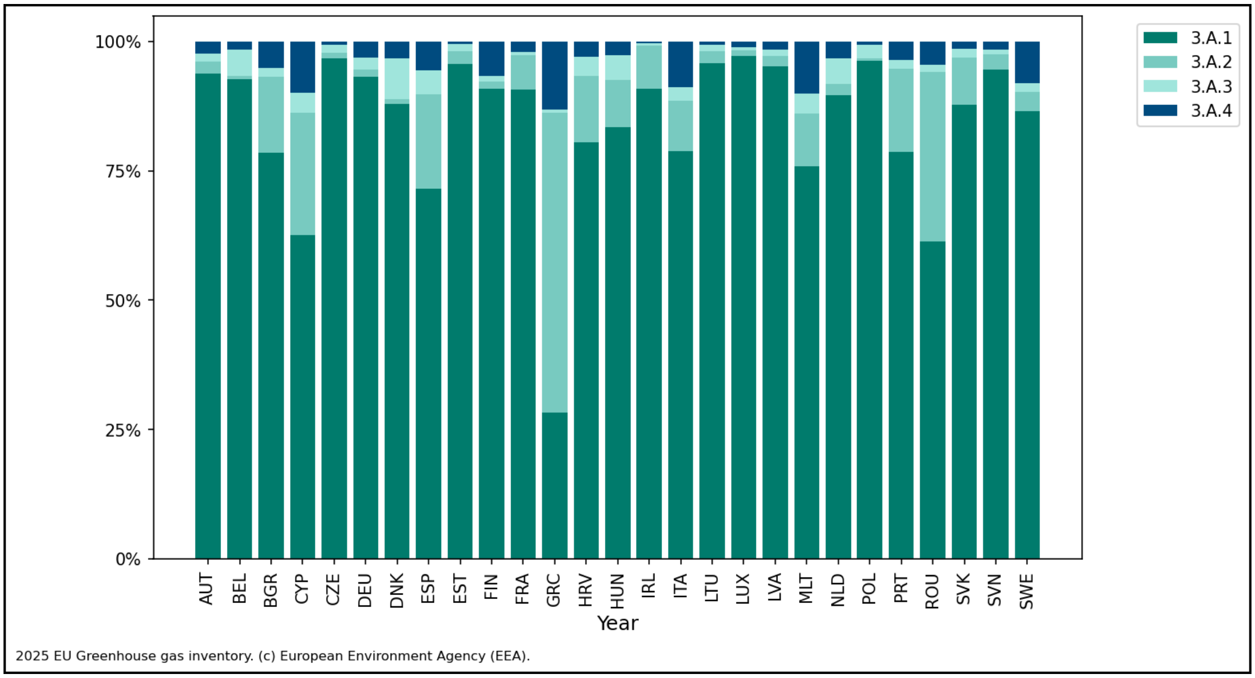
The main sub-categories are 3.A.1 (Cattle) and 3.A.2 (Sheep) as shown in Figure 5.2. Regarding the origin of emissions in the different countries, Figure 5.3 shows the distribution of CH_4 emissions from enteric fermentation by livestock category in all countries. Each bar represents the total emissions of a country in the current emission category, where different shades of blue correspond to the emitting animal types.

Figure 5.2 Share of source category 3.A on total EU agricultural emissions (left panel) and decomposition into its sub-categories (right panel). The percentages refer to the emissions in the year 2023.



In the left panel, some minor differences in the numbers might be present due to automatic rounding of numbers.

Figure 5.3 Decomposition of emissions in source category 3.A - Enteric Fermentation into its sub-categories by country in the year 2023.



CH_4 emissions from 3.A *Enteric Fermentation* are shown in Table 5.4 by country, and the total EU for the first and the last year of the inventory (1990 and 2023) is provided. Between 1990 and 2023, CH_4 emission in this source category decreased by 25 % or 61.2 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.1 %.

Table 5.4 3.A - Enteric Fermentation: Countries' contributions to total EU-CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	5 082	4 331	4 292	2.4%	-790	-16%	-39	-1%	NA,T2	CS,NA
Belgium	5 361	4 391	4 346	2.4%	-1 015	-19%	-46	-1%	NA,T1,T2	CS,D,NA
Bulgaria	5 379	1 669	1 608	0.9%	-3 772	-70%	-61	-4%	NA,T1,T2	CS,D,NA
Croatia	2 336	1 021	969	0.5%	-1 367	-59%	-52	-5%	NA,T1,T2,T3	CS,D,NA
Cyprus	221	332	336	0.2%	116	52%	4	1%	NA,T1,T2	CS,D,NA
Czechia	6 523	3 659	3 614	2.0%	-2 910	-45%	-45	-1%	NA,T1,T2	CS,D,NA
Denmark	4 455	4 099	3 974	2.2%	-481	-11%	-125	-3%	NA,T1,T2	CS,D,NA,OTH
Estonia	1 421	616	610	0.3%	-811	-57%	-6	-1%	NA,T1,T2	CS,D,NA
Finland	2 714	2 172	2 107	1.2%	-606	-22%	-65	-3%	NA,OTH,T1,T2	CS,D,NA,OTH
France	46 750	37 361	36 841	20.5%	-9 908	-21%	-519	-1%	T2,T3	CS
Germany	37 304	26 306	26 179	14.6%	-11 124	-30%	-126	0%	T1,T2,T3	CS,D
Greece	4 603	4 132	4 120	2.3%	-483	-10%	-12	0%	NA,T1,T2	CS,D,NA
Hungary	4 108	2 315	2 255	1.3%	-1 853	-45%	-60	-3%	T1,T2	CS,D
Ireland	12 480	13 363	13 039	7.3%	559	4%	-324	-2%	CS,NA,T1,T2	CS,D,NA
Italy	17 093	14 494	14 418	8.0%	-2 674	-16%	-75	-1%	NA,T1,T2	CS,D,NA
Latvia	2 488	947	885	0.5%	-1 603	-64%	-61	-6%	NA,T1,T2	CS,D,NA,OTH
Lithuania	4 880	1 763	1 743	1.0%	-3 137	-64%	-20	-1%	NA,T1,T2	CS,D,NA,OTH
Luxembourg	429	420	417	0.2%	-11	-3%	-2	-1%	NA,T1,T1a,T2	CS,D,NA
Malta	59	40	40	0.0%	-19	-32%	0	0%	NA,T1,T2	CS,D,NA
Netherlands	10 339	9 157	9 238	5.1%	-1 102	-11%	81	1%	NA,T1,T2,T3	CS,D,NA
Poland	22 008	14 427	14 634	8.2%	-7 373	-34%	208	1%	NA,T1,T2	CS,D,NA
Portugal	3 942	4 010	3 915	2.2%	-26	-1%	-95	-2%	T1,T2	CS,D
Romania	17 195	8 444	8 389	4.7%	-8 807	-51%	-55	-1%	NA,T1,T2	CS,D,NA
Slovakia	3 120	1 039	1 037	0.6%	-2 083	-67%	-1	0%	NA,T1,T2	CS,D,NA
Slovenia	1 067	998	976	0.5%	-91	-9%	-22	-2%	NA,T1,T2	CS,D,NA
Spain	15 623	16 669	16 180	9.0%	557	4%	-489	-3%	S,NA,T1,T2,T3	CS,D,NA
Sweden	3 680	3 317	3 320	1.8%	-360	-10%	3	0%	CS,T1	CS,D
EU-27	**240 658**	**181 490**	**179 484**	**100%**	**-61 175**	**-25%**	**-2 007**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

CH_4 emissions by country from *3.A.1 - Cattle Enteric Fermentation* are shown in Table 5.5 and total EU for the first and the last year of the inventory (1990 and 2023) is provided. Values are given in kt CO_2-eq. Between 1990 and 2023, CH_4 emission in this source category decreased by 25 % or 51.0 Mt CO_2-eq.

Table 5.5 3.A.1 - Cattle: Countries' contributions to GHG- CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	4 871	4 058	4 024	2.6%	-847	-17%	-35	-1%	T2	CS
Belgium	5 047	4 063	4 031	2.6%	-1 017	-20%	-32	-1%	T2	CS
Bulgaria	3 313	1 312	1 262	0.8%	-2 051	-62%	-50	-4%	T2	CS
Croatia	2 052	808	780	0.5%	-1 272	-62%	-28	-3%	T2,T3	CS
Cyprus	113	205	210	0.1%	97	85%	6	3%	T1,T2	CS,D
Czechia	6 213	3 541	3 495	2.3%	-2 718	-44%	-47	-1%	T2	CS
Denmark	4 031	3 565	3 496	2.3%	-534	-13%	-69	-2%	T2	CS,D
Estonia	1 355	588	583	0.4%	-772	-57%	-5	-1%	T2	CS,D
Finland	2 491	1 972	1 915	1.2%	-576	-23%	-58	-3%	T2	CS
France	41 825	33 912	33 432	21.8%	-8 392	-20%	-480	-1%	T3	CS
Germany	35 118	24 539	24 390	15.9%	-10 728	-31%	-149	-1%	T2,T3	CS,D
Greece	1 423	1 165	1 168	0.8%	-254	-18%	3	0%	T2	CS,D
Hungary	3 221	1 937	1 883	1.2%	-1 338	-42%	-54	-3%	T2	CS
Ireland	10 817	12 153	11 852	7.7%	1 035	10%	-301	-2%	CS,T2	CS
Italy	14 405	11 440	11 363	7.4%	-3 041	-21%	-76	-1%	T2	CS
Latvia	2 372	898	843	0.5%	-1 530	-64%	-55	-6%	T2	CS
Lithuania	4 717	1 687	1 669	1.1%	-3 049	-65%	-18	-1%	T2	CS
Luxembourg	421	408	406	0.3%	-15	-4%	-2	0%	T2	CS
Malta	49	31	30	0.0%	-19	-38%	-1	-2%	T2	CS
Netherlands	9 179	8 181	8 284	5.4%	-894	-10%	103	1%	T2,T3	CS
Poland	19 759	13 871	14 088	9.2%	-5 671	-29%	218	2%	NA,T2	CS,NA
Portugal	2 755	3 163	3 078	2.0%	323	12%	-85	-3%	T2	CS
Romania	12 595	5 187	5 147	3.3%	-7 448	-59%	-40	-1%	T2	CS
Slovakia	2 794	910	910	0.6%	-1 884	-67%	1	0%	T2	CS
Slovenia	1 029	944	923	0.6%	-106	-10%	-21	-2%	T2	CS
Spain	9 545	11 862	11 563	7.5%	2 019	21%	-298	-3%	CS,T2	CS,D
Sweden	3 230	2 860	2 872	1.9%	-357	-11%	12	0%	CS	CS
EU-27	**204 739**	**155 261**	**153 699**	**100%**	**-51 039**	**-25%**	**-1 561**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

CH_4 emissions by country from *3.A.2 - Sheep Enteric Fermentation* are shown in Table 5.6 and the total EU for the first and the last year of the inventory (1990 and 2023) is provided. Values are given in kt CO_2-eq. Between 1990 and 2023, CH_4 emission in this source category decreased by 33 % or 7.7 Mt CO_2-eq.

Table 5.6 3.A.2 - Sheep: Countries' contributions to total EU-CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	82	107	105	0.7%	23	28%	-2	-2%	T2	CS
Belgium	32	24	23	0.2%	-9	-27%	0	-1%	T1	D
Bulgaria	1 627	247	236	1.5%	-1 391	-86%	-11	-5%	T2	CS
Croatia	168	144	124	0.8%	-45	-26%	-20	-14%	T1	D
Cyprus	65	77	79	0.5%	14	22%	2	3%	T1	D
Czechia	96	39	39	0.3%	-57	-59%	0	0%	T1	D
Denmark	44	37	36	0.2%	-8	-19%	-1	-2%	T2	D
Estonia	36	16	15	0.1%	-21	-58%	-1	-6%	T1	D
Finland	24	32	30	0.2%	6	24%	-3	-8%	CS	CS
France	3 957	2 425	2 405	15.6%	-1 552	-39%	-19	-1%	T3	CS
Germany	651	361	369	2.4%	-282	-43%	8	2%	T1	CS,D
Greece	2 300	2 391	2 382	15.4%	82	4%	-9	0%	T2	CS,D
Hungary	439	202	203	1.3%	-236	-54%	0	0%	T1	D
Ireland	1 577	1 109	1 088	7.0%	-489	-31%	-21	-2%	CS,T2	CS
Italy	1 761	1 422	1 407	9.1%	-354	-20%	-15	-1%	T2	CS
Latvia	37	20	18	0.1%	-19	-52%	-2	-10%	T1	D
Lithuania	21	43	42	0.3%	21	104%	-1	-1%	T2	CS
Luxembourg	3	4	4	0.0%	1	53%	0	0%	T1	D
Malta	4	4	4	0.0%	0	2%	0	-3%	T2	CS
Netherlands	381	203	199	1.3%	-182	-48%	-4	-2%	T1	D
Poland	932	65	62	0.4%	-869	-93%	-3	-4%	T1	D
Portugal	888	637	630	4.1%	-258	-29%	-7	-1%	T2	CS
Romania	3 498	2 710	2 744	17.8%	-754	-22%	34	1%	T2	CS
Slovakia	204	98	94	0.6%	-109	-54%	-4	-4%	T2	CS
Slovenia	5	30	29	0.2%	24	474%	0	-1%	T1	D
Spain	4 246	3 106	2 953	19.1%	-1 293	-30%	-153	-5%	CS,T2	CS
Sweden	102	129	122	0.8%	20	20%	-6	-5%	T1	D
EU-27	**23 179**	**15 680**	**15 442**	**100%**	**-7 737**	**-33%**	**-237**	**-2%**	**-**	**-**

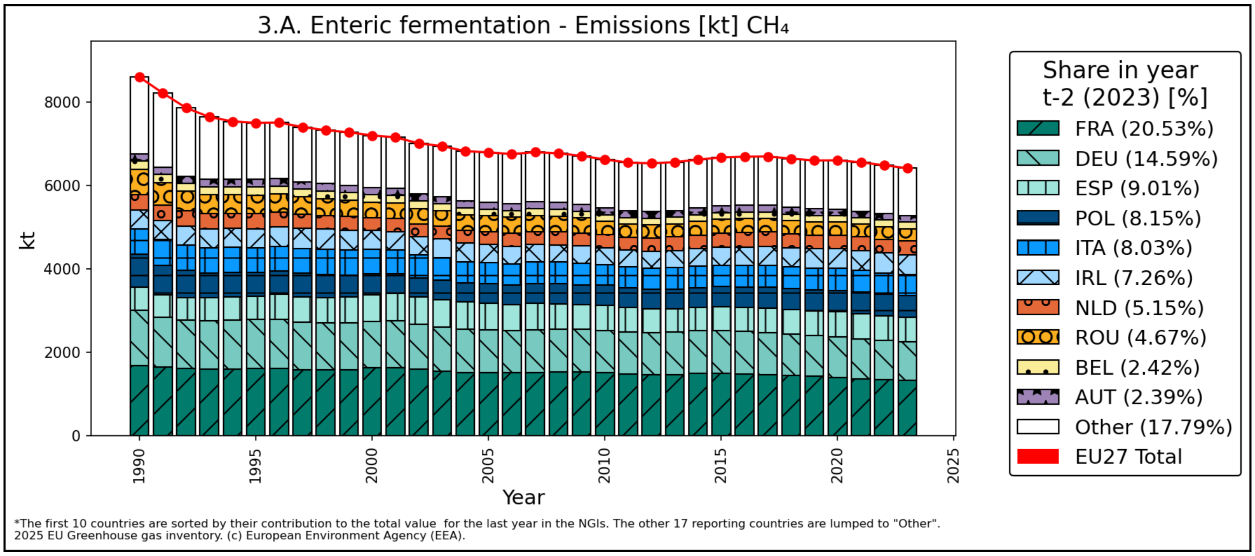
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

5.3.1.1 Trends in Emissions and Activity Data

3.A - Enteric Fermentation - Emissions

Emissions in source category *3.A - Enteric Fermentation* decreased considerably in the EU by 25 % or 61.2 Mt CO_2-eq in the period 1990 to 2023. Figure 5.4 shows the trend of emissions indicating the countries contributing most to EU total. The figure represents the trend in CH_4 emissions from enteric fermentation for the different countries along the inventory period.

Figure 5.4 *3.A: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023*



3.A.1 - Cattle - Emissions

Emissions in source category *3.A.1 - Cattle* decreased considerably in the EU by 25 % or 51.0 Mt CO_2-eq in the period 1990 to 2023.

Figure 5.5 shows the trend of emissions in source category *3.A.1.a - Dairy Cattle*, indicating the countries contributing most to EU total. Figure 5.6 shows the trend of emissions in source category *3.A.1.b - Non-Dairy Cattle*, indicating the countries contributing most to EU total.

Figure 5.5 *3.A.1.a Dairy Cattle: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023*

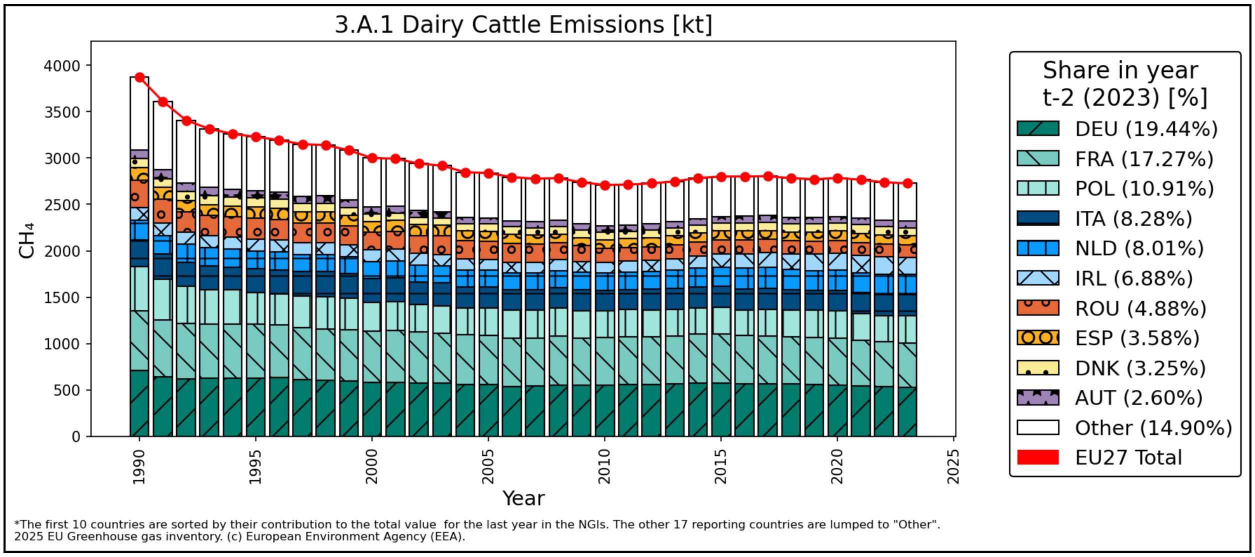
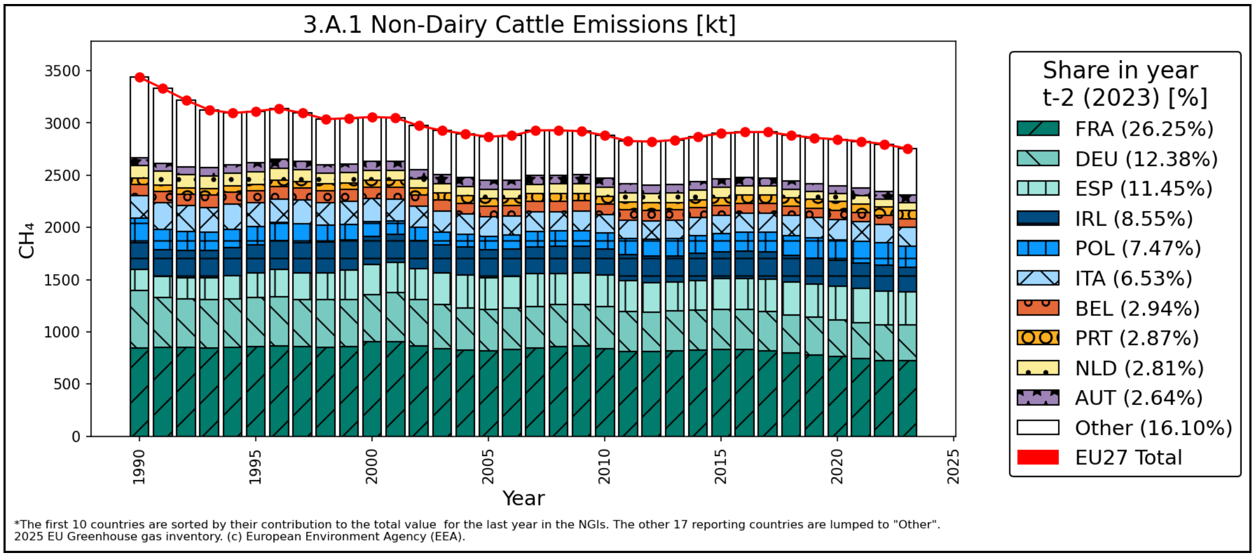


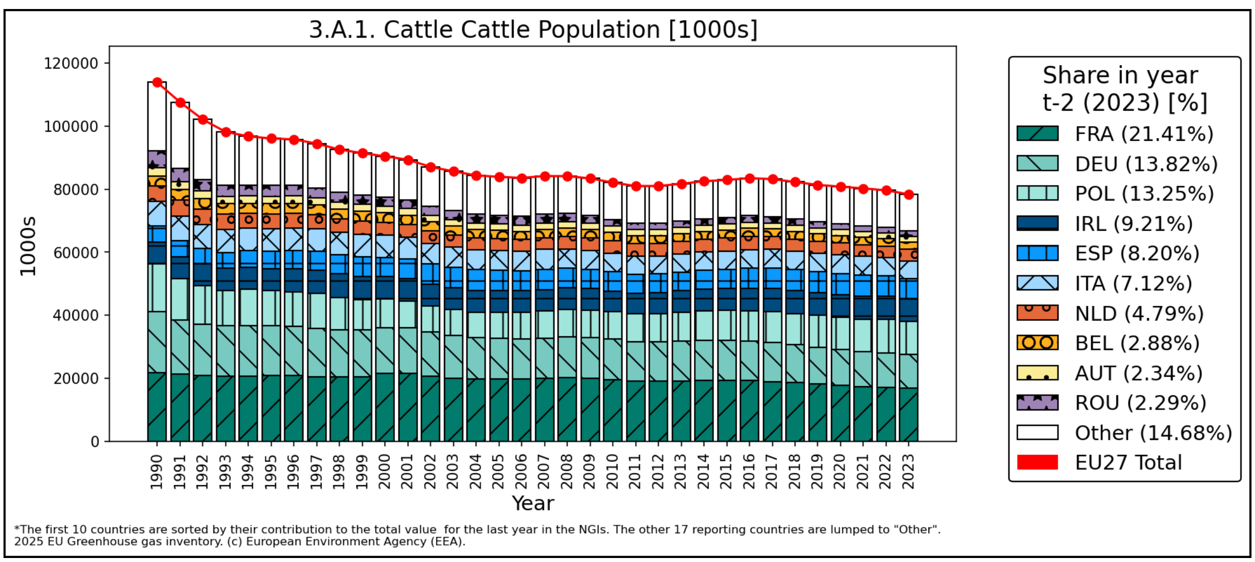
Figure 5.6 3.A.1.b Non-Dairy Cattle: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.A.1 - Cattle - Population

The main driver for the decrease of CH_4 emissions from enteric fermentation is the decrease in animal numbers that we can see in Figure 5.7, which represents a strong decrease in the EU in the period 1990 to 2023. Figure 5.8 shows the population of dairy cattle and Figure 5.9 the population of non-dairy cattle.

Figure 5.7 3.A.1 Cattle: Trend in cattle population in the EU and the countries contributing most to EU values including their share to EU population in 2023



<u>To be noted</u>: due to reporting issue, the graph above double counts the non-dairy population for Poland. Efforts will be made next year to improve the reporting.

Figure 5.8 3.A.1.a Dairy cattle: Trend in dairy cattle population in the EU and the countries contributing most to EU values including their share to EU population in 2023

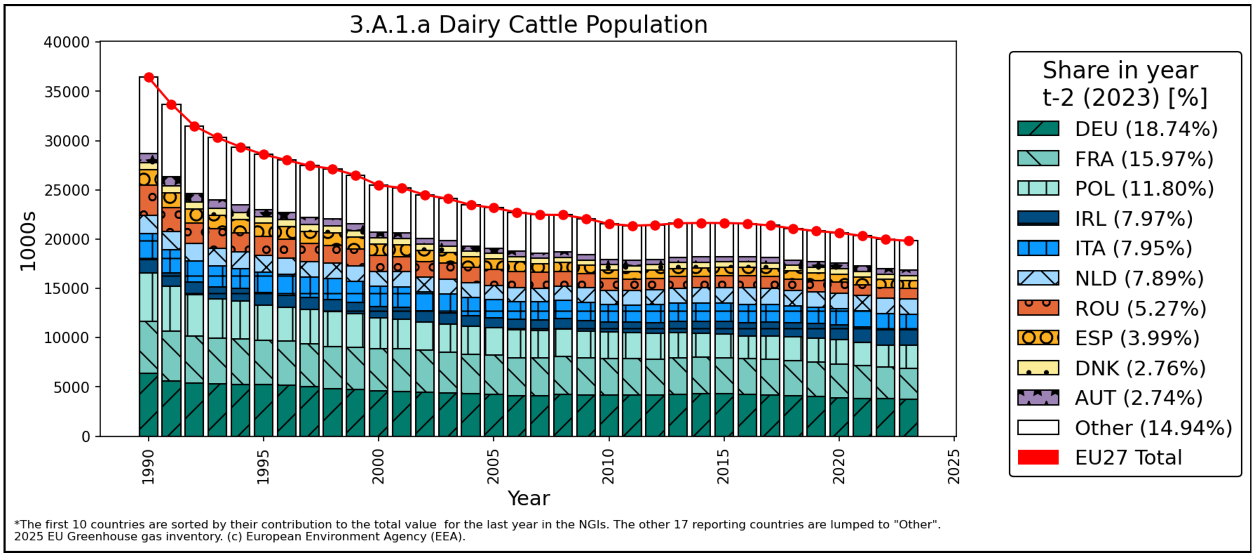
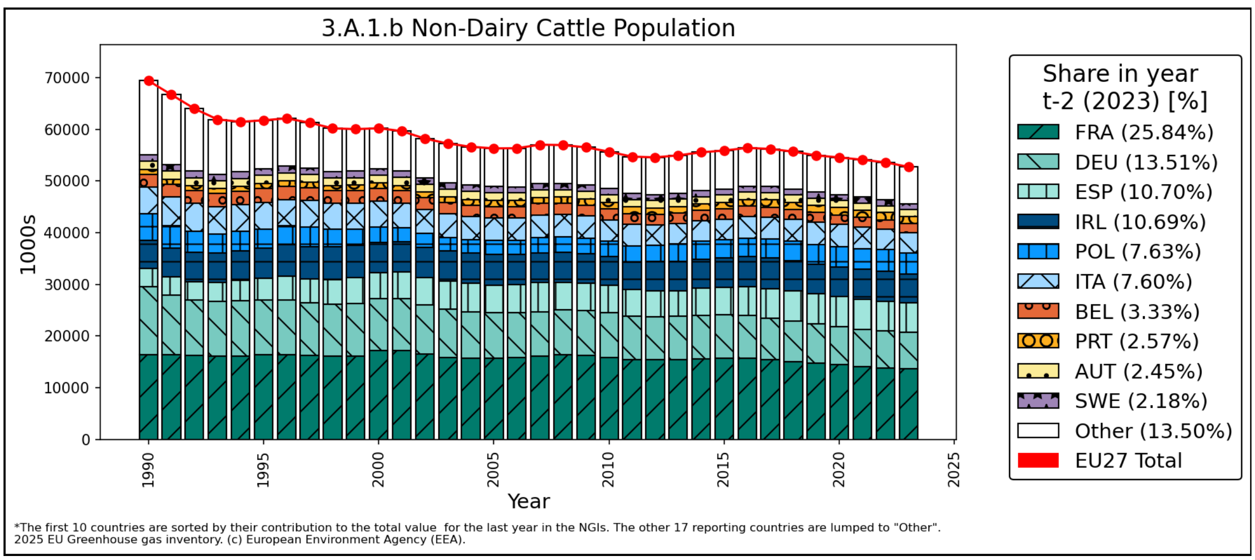


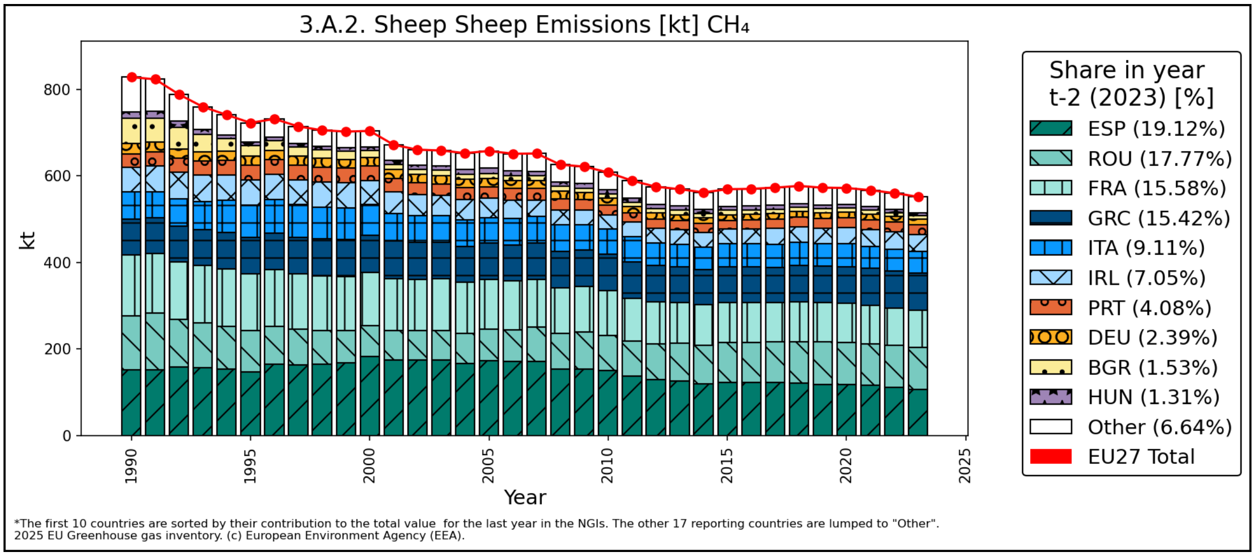
Figure 5.9 3.A.1.b Non-dairy cattle: Trend in non-dairy cattle population in the EU and the countries contributing most to EU values including their share to EU population in 2023



3.A.2 - Sheep - Emissions

Emissions in source category *3.A.2 - Sheep* decreased strongly in the EU by 33.4 % or 7.7 Mt CO_2-eq in the period 1990 to 2023. Figure 5.10 shows the trend of emissions indicating the countries contributing most to EU total.

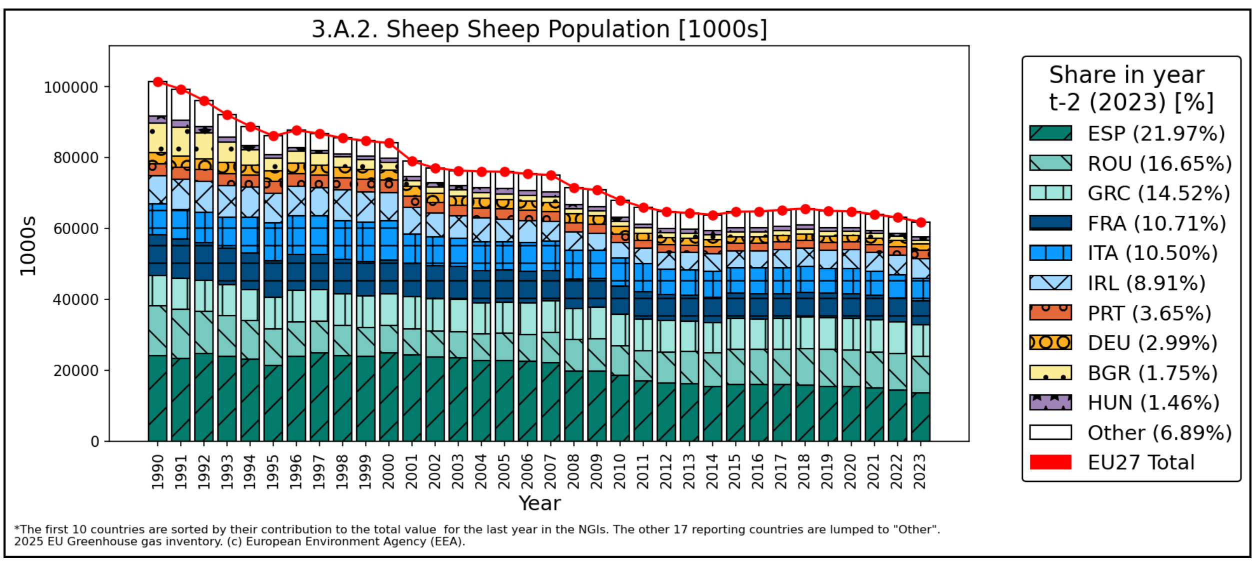
Figure 5.10 3.A.2: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.A.2 - Sheep - Population

The main driver for the decrease of CH_4 emissions from enteric fermentation for sheep was the decrease in animal numbers shown in Figure 5.11.

Figure 5.11 3.A.2: Trend in sheep population in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



5.3.1.2 Implied EFs and Methodological Issues

Information for cattle, sheep and swine are reported using national classification of the animals. For example, it is possible to report cattle numbers using one of two options:

- Option A distinguishes ‘Dairy Cattle’ and ‘Non-Dairy Cattle’.

- Option B distinguishes ‘Mature Dairy Cattle’, ‘Other Mature Cattle’ and ‘Growing Cattle’.

To obtain values that can be aggregated to EU level, data reported under Option B were converted to Option A categories. ‘Mature Dairy Cattle’ is taken for ‘Dairy Cattle’ and the other two categories under Option B are used for ‘Non-Dairy Cattle’.

In case data were aggregated, this was done on the basis of a weighted average using population data as weighting factors.

In the cases for ‘Sheep’ and ‘Swine’, all animal types reported by countries are aggregated to one single parent category using the same approach.

In this section we discuss the Implied Emission Factor for the main animal types. Furthermore, we present data on the average gross energy intake and - for dairy cattle - also the milk yield.

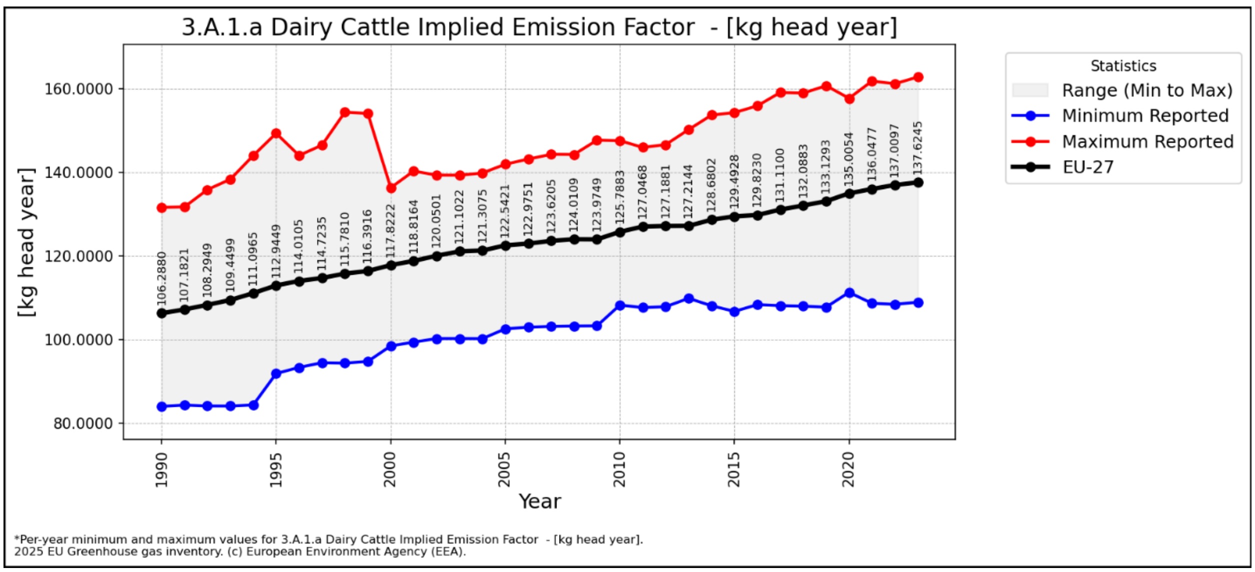
3.A.1 - Cattle - Implied emission factor

For cattle, the analysis is conducted per subcategory.

3.A.1.a - Dairy Cattle - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.A.1.a - Dairy Cattle* increased in the EU strongly between 1990 and 2023. Figure 5.12 shows the trend of the implied emission factor indicating also the range of values used by the countries.

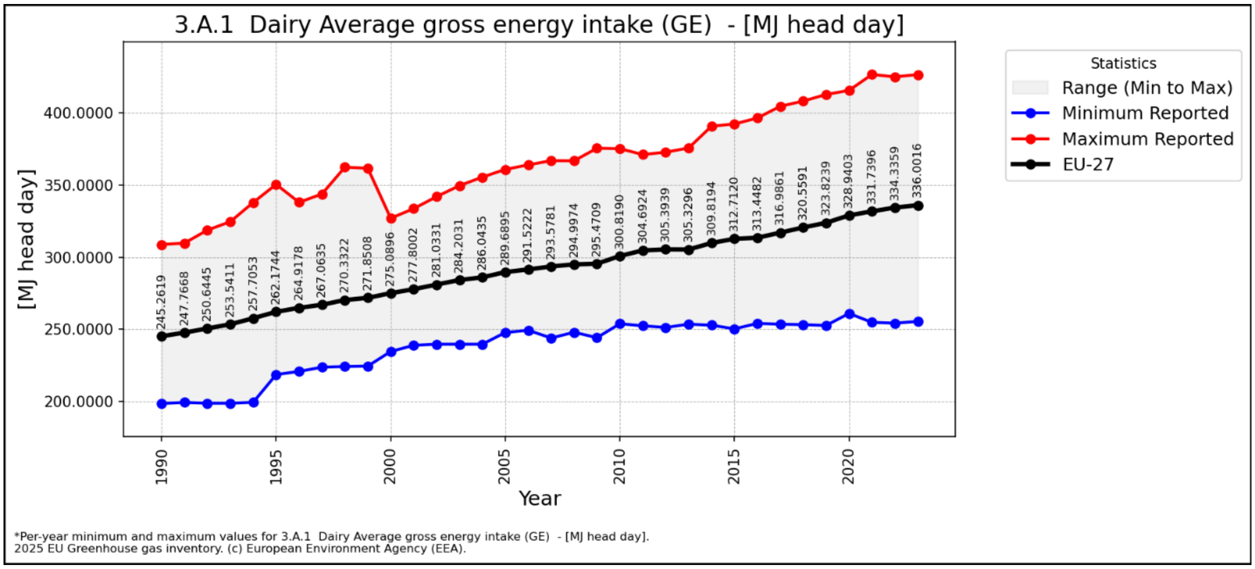
Figure 5.12 3.A.1 - Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.A.1.a - Dairy Cattle - Gross energy

The gross energy, a parameter used for calculating CH_4 emissions in source category *3.A.1.a - Dairy Cattle*, increased in the EU strongly between 1990 and 2023. Figure 5.13 shows the trend of the gross energy indicating also the range of values used by the countries

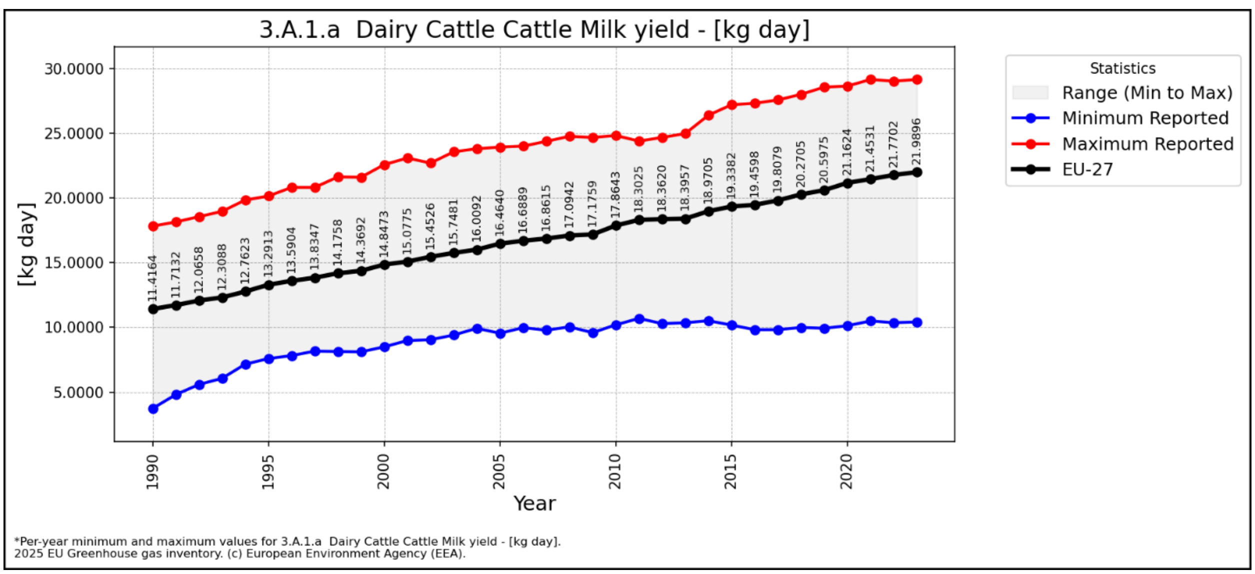
Figure 5.13 3.A.1.a - Dairy Cattle: Trend in gross energy and range of values reported by countries



3.A.1.a - Dairy Cattle - Milk yield

The milk yield, a parameter used for calculating CH_4 emissions in source category *3.A.1.a - Dairy Cattle*, increased in the EU very strongly between 1990 and 2023. Figure 5.14 shows the trend of the milk yield indicating also the range of values used by the countries.

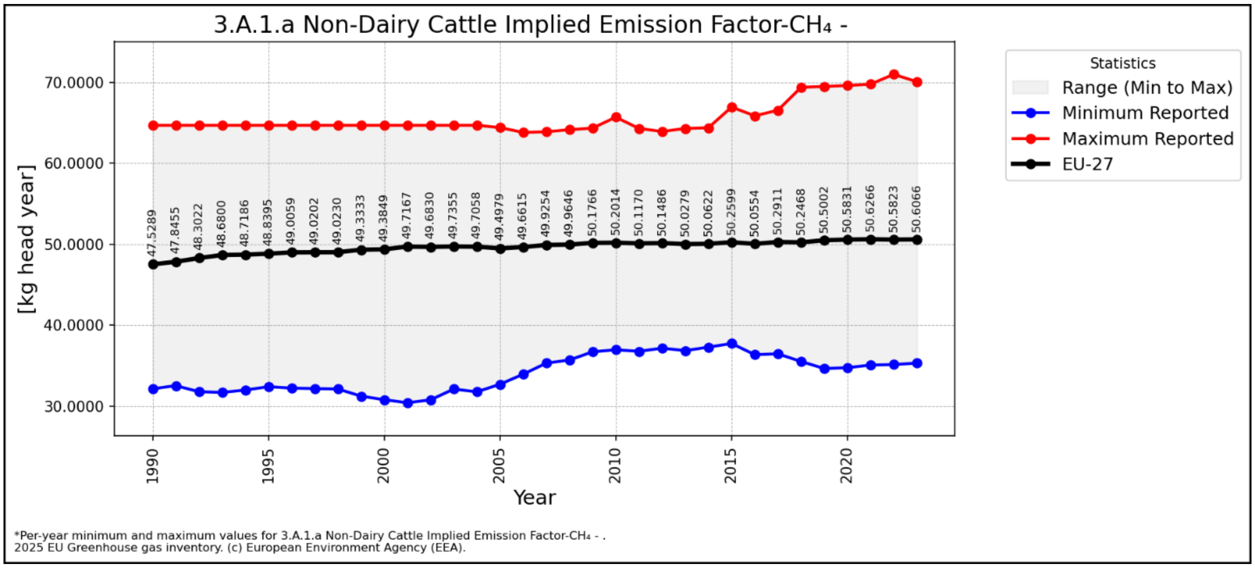
Figure 5.14 3.A.1.a - Dairy Cattle: Trend in milk yield and range of values reported by countries



3.A.1.b - Non-Dairy Cattle - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.A.1.b - Non-Dairy Cattle* increased in the EU moderately between 1990 and 2023. Figure 5.15 shows the trend of the implied emission factor indicating also the range of values used by the countries.

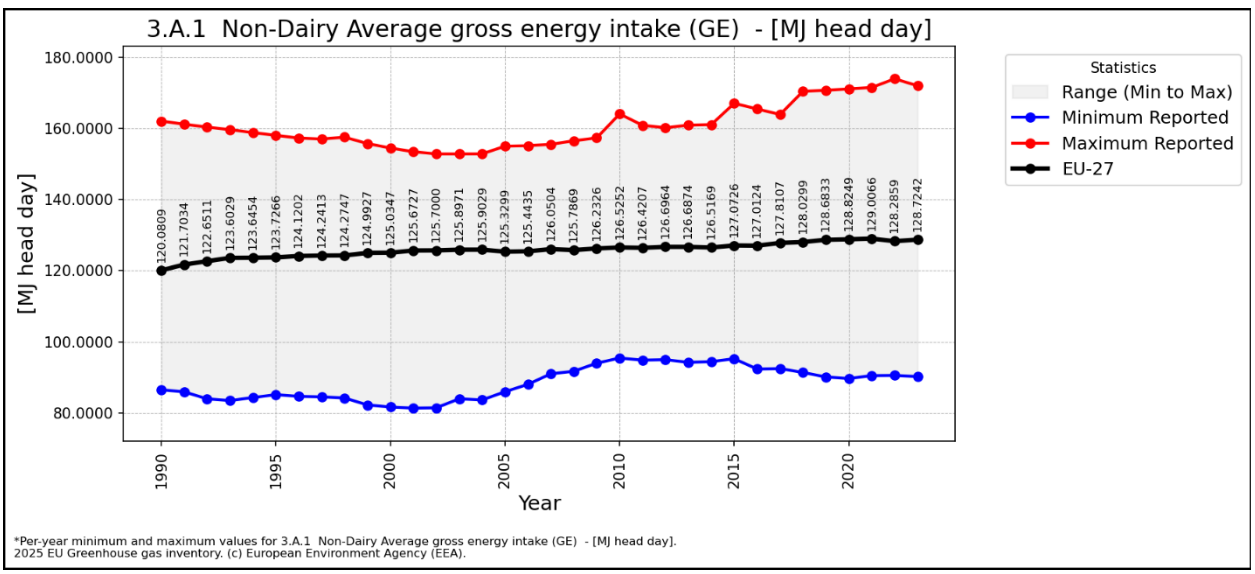
Figure 5.15 3.A.1.b - Non-Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.A.1.b - Non-Dairy Cattle - Average gross energy intake

The average gross energy intake, a parameter used for calculating CH_4 emissions in source category *3.A.1.b - Non-Dairy Cattle*, increased in the EU moderately between 1990 and 2022. Figure 5.16 shows the trend of the average gross energy intake indicating also the range of values used by the countries.

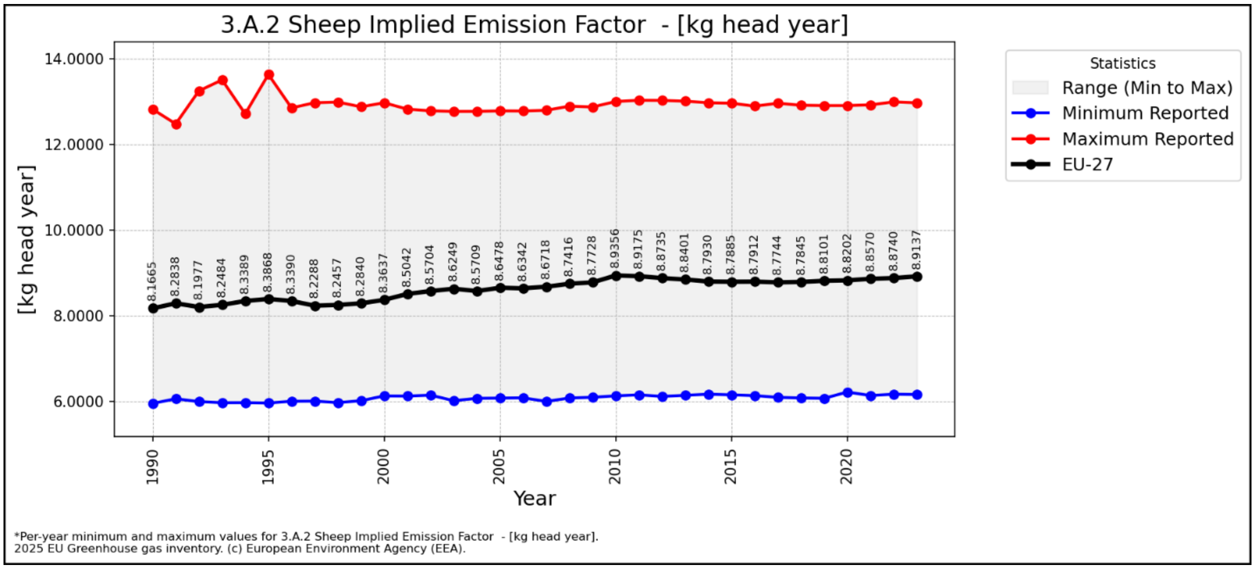
Figure 5.16 3.A.1.b - Non-Dairy Cattle: Trend in average gross energy intake and range of values reported by countries



3.A.2 - Sheep - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.A.2 - Sheep* increased in the EU moderately between 1990 and 2023. Figure 5.17 shows the trend of the implied emission factor indicating also the range of values used by the countries.

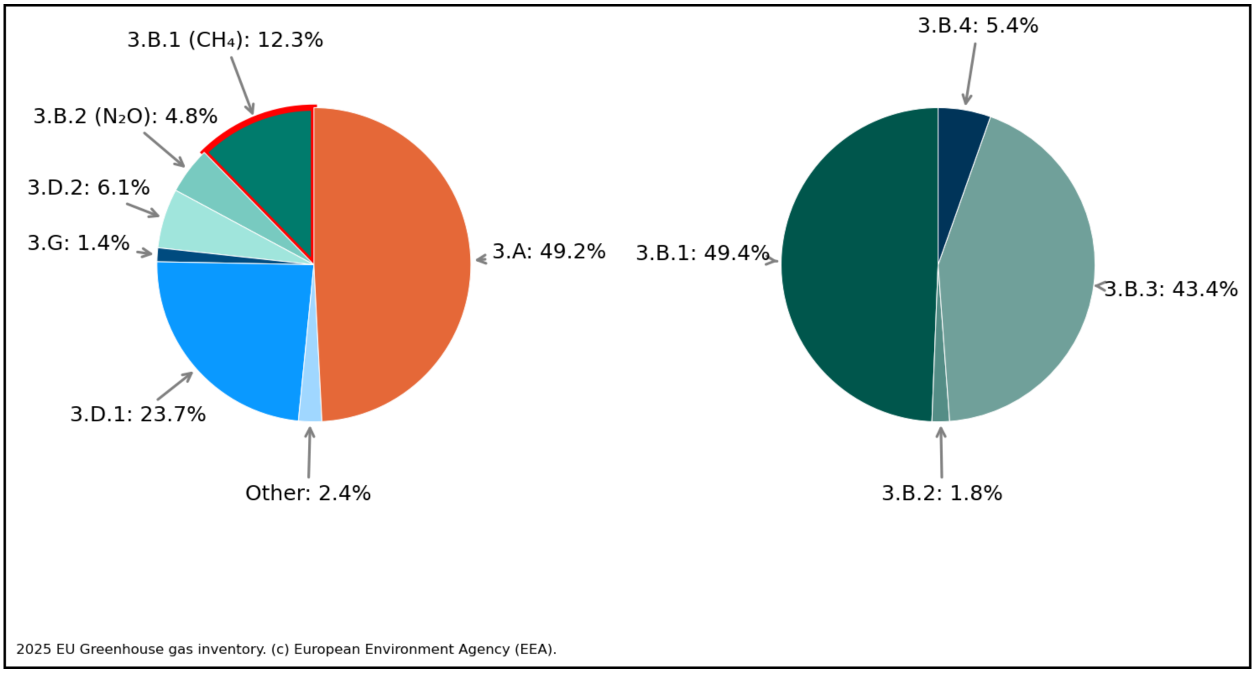
Figure 5.17 3.A.2 - Sheep: Trend in implied emission factor and range of values reported by countries



5.3.2 Manure Management - CH_4 (CRT Source Category 3B)

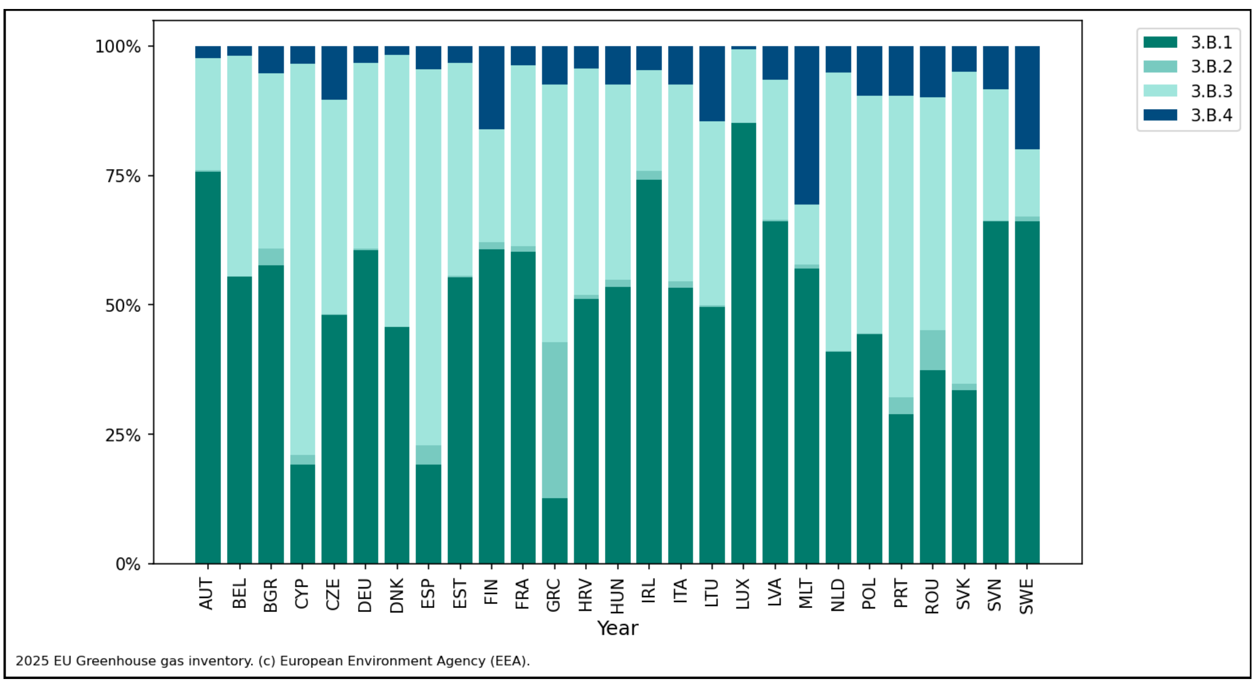
In 2023 CH_4 emissions in source category *3.B - Manure Management* in the EU were 44941 kt CO_2 equivalent. This corresponds to 1.5 % of total EU GHG emissions and 11.2 % of total EU CH_4 emissions. They make 12.3 % of total agricultural emissions and 19.6 % of total agricultural CH_4 emissions. The main sub-categories are Cattle (3.B.1) and Swine (3.B.3) as shown in Figure 5.18. Regarding the origin of emissions in the different countries, Figure 5.19 shows the distribution of CH_4 emissions from manure management by livestock category in all countries. Each bar represents the total emissions of a country in the current emission category, where different shades of blue correspond to the emitting animal types.

Figure 5.18 Share of source category 3.B on total EU agricultural emissions (left panel) and decomposition into its sub-categories (right panel). The percentages refer to the emissions in the year 2023.



In the left panel, some minor differences in the numbers might be present due to automatic rounding of numbers.

Figure 5.19 Decomposition of emissions in source category 3.B - Manure Management into its sub-categories by country in the year 2023.



CH_4 emissions by country and for the total EU from 3.B *Manure Management* are shown in Table 5.7 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, CH_4 emission in this source category decreased by 19.7 % or 11.0 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 2.9 %.

Table 5.7 3.B - Manure Management: Countries' contributions to EU-CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	681	791	798	1.8%	117	17%	7	1%	NA,T1,T2	CS,D,NA
Belgium	1 546	1 358	1 335	3.0%	-211	-14%	-22	-2%	NA,T1,T2	CS,D,NA
Bulgaria	1 213	363	357	0.8%	-856	-71%	-6	-2%	T1,T2	CS,D
Croatia	492	390	371	0.8%	-121	-25%	-20	-5%	T2	CS,D
Cyprus	114	77	75	0.2%	-39	-34%	-2	-2%	T1,T2	D
Czechia	1 539	362	355	0.8%	-1 185	-77%	-7	-2%	T1,T2	CS,D
Denmark	3 024	3 660	3 164	7.0%	140	5%	-496	-14%	T2,T3	CS,D
Estonia	186	164	165	0.4%	-21	-11%	0	0%	NA,T1,T2	CS,D,NA
Finland	529	539	518	1.2%	-11	-2%	-20	-4%	T2	CS
France	6 791	6 722	6 428	14.3%	-363	-5%	-294	-4%	T2	CS,D
Germany	8 484	6 372	6 346	14.1%	-2 138	-25%	-26	0%	T2	CS,D,NA
Greece	939	725	721	1.6%	-218	-23%	-4	-1%	T1,T2	CS,D
Hungary	1 240	665	631	1.4%	-609	-49%	-34	-5%	T1,T2	CS,D
Ireland	1 815	1 934	1 889	4.2%	74	4%	-45	-2%	NA,T1,T2	CS,D,NA
Italy	5 424	4 787	4 848	10.8%	-576	-11%	61	1%	T1,T2	CS,D
Latvia	213	109	101	0.2%	-111	-52%	-7	-7%	T1,T2	CS,D
Lithuania	750	254	250	0.6%	-500	-67%	-3	-1%	NA,T1,T2	CS,D,NA
Luxembourg	87	99	95	0.2%	8	9%	-3	-3%	NA,T1,T1a,T2	CS,D,NA
Malta	10	6	7	0.0%	-4	-35%	0	4%	NA,T1,T2	CS,D,NA
Netherlands	6 155	3 984	3 800	8.5%	-2 355	-38%	-184	-5%	NA,T1,T2	CS,D,NA
Poland	2 338	1 566	1 631	3.6%	-708	-30%	65	4%	NA,T1,T2	CS,D,NA
Portugal	907	832	818	1.8%	-90	-10%	-15	-2%	T1,T2	CS,D
Romania	2 087	683	665	1.5%	-1 422	-68%	-18	-3%	NA,T1,T2	CS,D,NA
Slovakia	716	101	101	0.2%	-615	-86%	0	0%	T1,T2	CS
Slovenia	371	193	192	0.4%	-180	-48%	-2	-1%	T1,T2	CS,D
Spain	8 056	9 200	8 943	19.9%	887	11%	-257	-3%	NA,T1,T2	CS,D,NA
Sweden	264	344	338	0.8%	75	28%	-5	-2%	T1,T2	CS,D
EU-27	**55 973**	**46 277**	**44 941**	**100%**	**-11 033**	**-20%**	**-1 337**	**-3%**	**-**	**-**

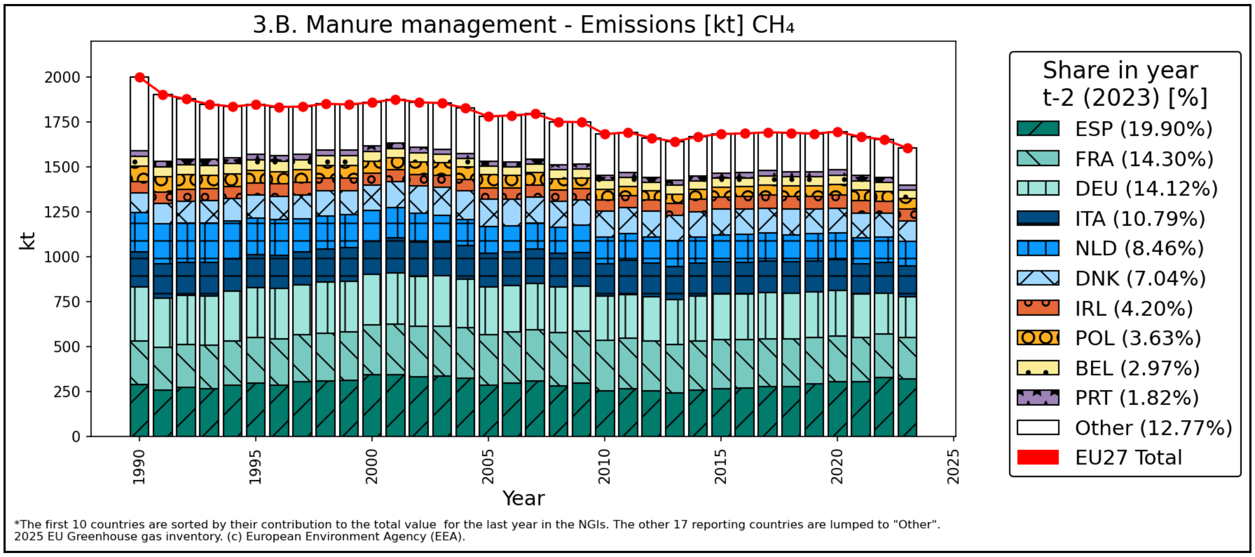
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

5.3.2.1 Trends in Emissions and Activity Data

3.B- Manure Management - CH_4 Emissions

CH_4 emissions in source category *3.B- Manure Management* decreased considerably in the EU by 19.7 % or 11.0 Mt CO_2-eq in the period 1990 to 2023. Figure 5.20 shows the trend of emissions indicating the countries contributing most to the EU total.

Figure 5.20 3.B: Trend in CH_4 emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B. 1 - Cattle - Emissions

In 2023 CH_4 emissions in source category *3.B.1 - Cattle* in the EU were 22188 kt CO_2 equivalent. It represents 6.1 % of total agricultural emissions and 9.7 % of total agricultural CH_4 emissions. Figure 5.21 and Figure 5.22 show the trend of emissions for Dairy and Non-Dairy Cattle indicating the countries contributing most to EU.

CH_4 emissions by country and for the total EU from 3.B.1 *Manure Management* are shown in Table 5.8 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, CH_4 emission in this source category decreased by 17 % or 4.5 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.8%.

Table 5.8 3.B.1 - Cattle: Countries' contributions to total EU-CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	482	654	665	3.0%	183	38%	11	2%	T2	CS,D
Belgium	922	772	783	3.5%	-139	-15%	11	1%	T2	CS
Bulgaria	510	265	255	1.1%	-255	-50%	-10	-4%	T2	CS
Croatia	250	201	194	0.9%	-56	-22%	-6	-3%	T2	CS,D
Cyprus	19	31	32	0.1%	13	65%	1	3%	T2	D
Czechia	810	226	225	1.0%	-585	-72%	-1	0%	T2	CS,D
Denmark	1 533	1 751	1 660	7.5%	127	8%	-91	-5%	T2,T3	CS,D
Estonia	60	120	117	0.5%	57	95%	-3	-2%	T2	CS,D
Finland	350	381	366	1.6%	16	5%	-15	-4%	T2	CS
France	4 455	4 018	3 875	17.5%	-580	-13%	-144	-4%	T2	CS,D
Germany	5 153	4 091	4 066	18.3%	-1 087	-21%	-25	-1%	T2	CS
Greece	137	79	79	0.4%	-58	-42%	0	0%	T2	CS,D
Hungary	680	423	411	1.9%	-269	-40%	-12	-3%	T2	CS
Ireland	1 417	1 431	1 398	6.3%	-19	-1%	-33	-2%	T2	CS
Italy	3 176	2 366	2 343	10.6%	-833	-26%	-24	-1%	T2	CS
Latvia	124	85	79	0.4%	-45	-36%	-6	-7%	T2	CS
Lithuania	286	188	190	0.9%	-96	-34%	2	1%	T2	CS
Luxembourg	76	86	84	0.4%	8	10%	-2	-3%	T2	CS
Malta	6	3	3	0.0%	-3	-52%	0	-2%	T2	CS
Netherlands	1 801	2 208	2 123	9.6%	322	18%	-85	-4%	T2	CS
Poland	1 074	702	766	3.5%	-308	-29%	64	9%	NA,T2	CS,NA
Portugal	222	245	241	1.1%	19	8%	-4	-2%	T2	CS,D
Romania	732	259	256	1.2%	-475	-65%	-3	-1%	T2	CS
Slovakia	195	54	54	0.2%	-141	-72%	0	0%	T2	CS
Slovenia	199	160	157	0.7%	-42	-21%	-3	-2%	T2	CS,D
Spain	1 848	1 579	1 555	7.0%	-293	-16%	-25	-2%	T2	CS,D
Sweden	171	212	211	1.0%	40	23%	-1	0%	T2	CS
EU-27	**26 689**	**22 590**	**22 188**	**100%**	**-4 501**	**-17%**	**-402**	**-2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.21 3.B.1.a: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023

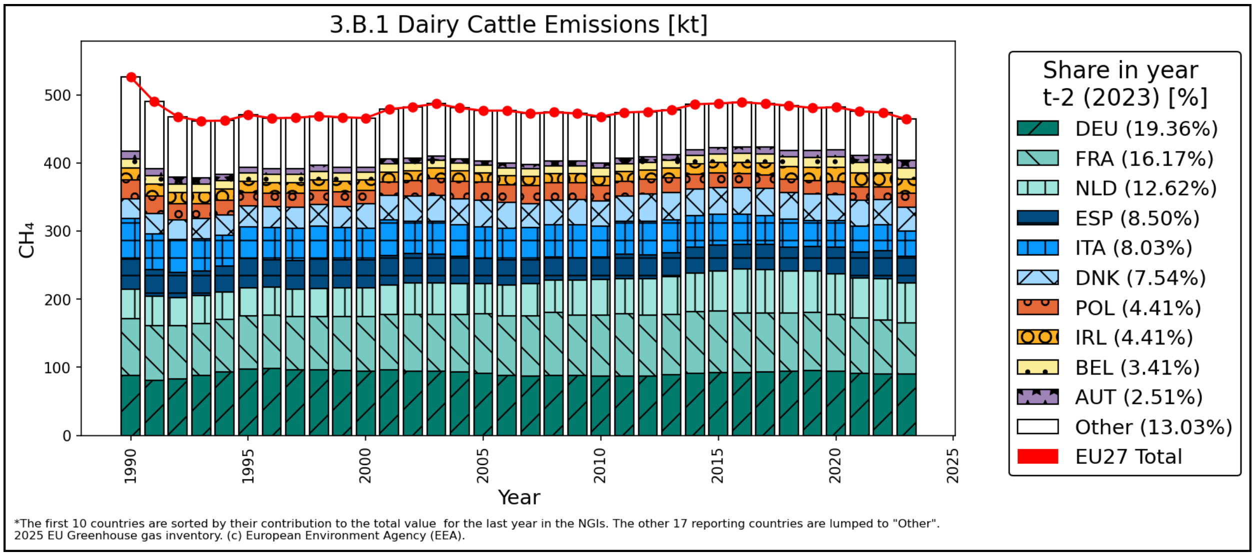
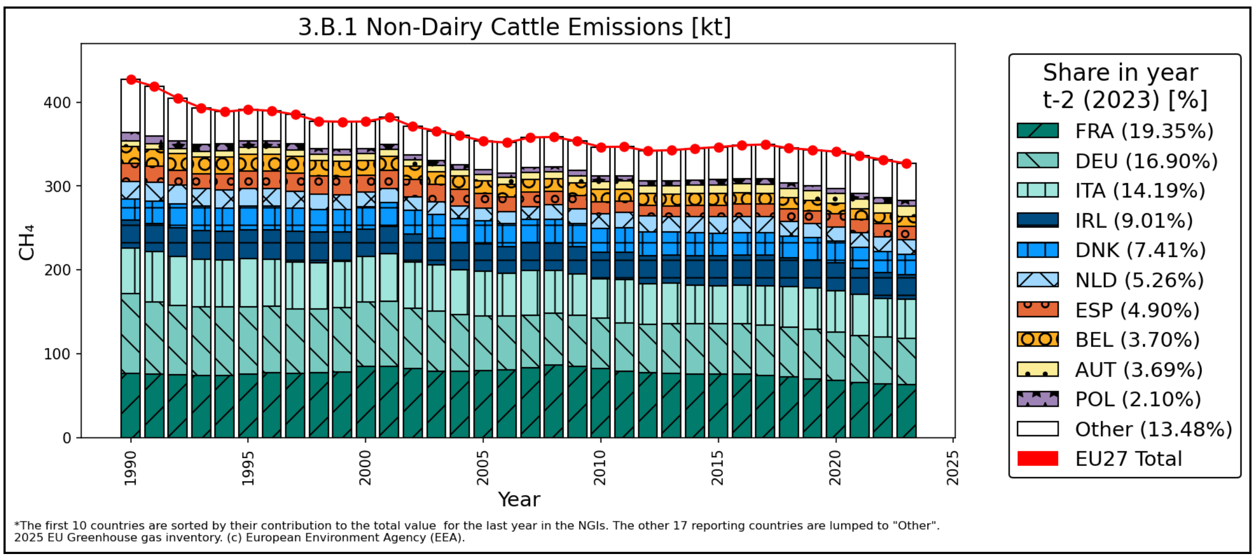


Figure 5.22 3.B.1.b: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B.1 - Cattle - Activity Data

The main activity data for CH_4 emissions from manure management - cattle are the animal numbers. Cattle numbers are already discussed under source category 3.A Enteric Fermentation and therefore not further discussed here. Other relevant activity data are the allocation by climate region and the allocation by manure management system (MMS).

3.B.3 - Swine - Emissions

In 2023 CH_4 emissions in source category *3.B.3 - Swine* in the EU were 19507 kt CO_2 equivalent. It represents 5.3 % of total agricultural emissions and 8.5 % of total agricultural CH_4 emissions.

CH_4 emissions by country and for the total EU from 3.B.3 *Manure Management* are shown in Table 5.9 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, CH_4 emission in this source category decreased by 23 % or 5.9 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 4.5 %.

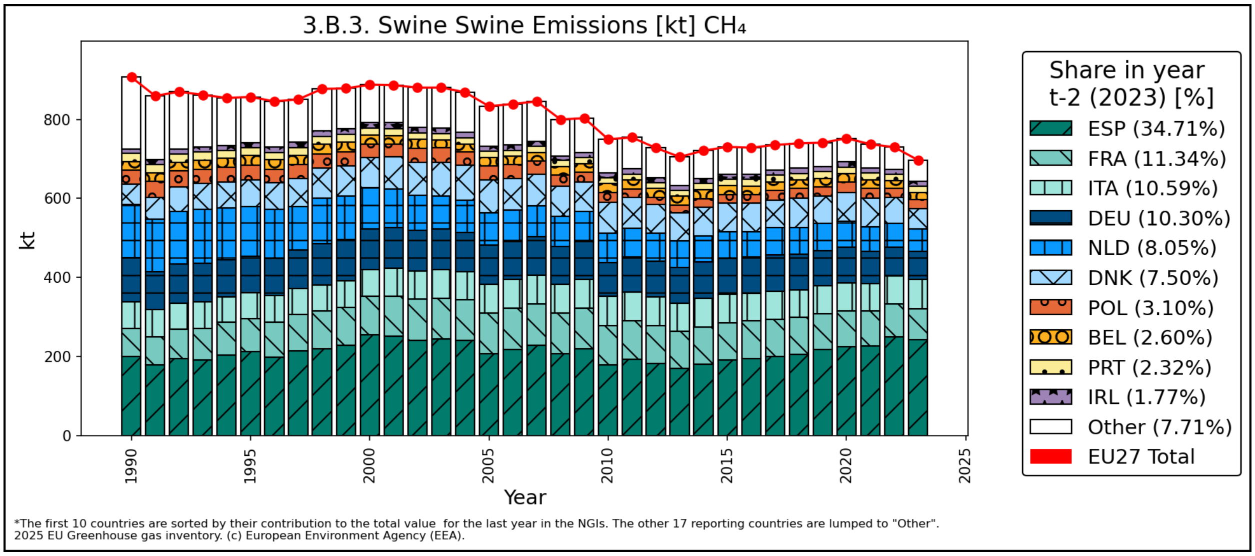
Figure 5.23 shows the trend of emissions indicating the countries contributing most to EU total.

Table 5.9 3.B.3 - Swine: Countries' contributions to total EU-GHG and CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	184	116	111	0.6%	-73	-40%	-4	-4%	T2	CS,D
Belgium	610	541	508	2.6%	-103	-17%	-34	-6%	T2	CS
Bulgaria	609	76	81	0.4%	-528	-87%	5	6%	T2	CS
Croatia	201	173	159	0.8%	-42	-21%	-14	-8%	T2	CS,D
Cyprus	89	39	37	0.2%	-52	-59%	-2	-6%	T2	D
Czechia	612	68	67	0.3%	-545	-89%	-1	-2%	T2	CS,D
Denmark	1 434	1 868	1 464	7.5%	30	2%	-404	-22%	-	CS
Estonia	116	42	45	0.2%	-71	-61%	3	8%	T2	CS,D
Finland	97	104	101	0.5%	4	4%	-2	-2%	T2	CS
France	1 981	2 358	2 211	11.3%	230	12%	-146	-6%	T2	CS,D
Germany	3 094	2 013	2 010	10.3%	-1 084	-35%	-3	0%	T2	CS
Greece	484	330	324	1.7%	-160	-33%	-6	-2%	T1	D
Hungary	453	203	181	0.9%	-272	-60%	-22	-11%	T2	CS
Ireland	286	357	345	1.8%	59	21%	-13	-4%	T2	CS,D
Italy	1 908	1 998	2 067	10.6%	159	8%	69	3%	T2	CS
Latvia	73	19	17	0.1%	-57	-77%	-2	-9%	T2	CS
Lithuania	369	34	30	0.2%	-339	-92%	-4	-12%	T2	CS
Luxembourg	11	12	10	0.1%	0	-4%	-1	-10%	T1	CS
Malta	1	0	1	0.0%	-1	-65%	0	21%	NA,T2	CS,NA
Netherlands	3 773	1 671	1 570	8.0%	-2 203	-58%	-101	-6%	T2	CS
Poland	1 022	617	606	3.1%	-417	-41%	-11	-2%	T1	CS
Portugal	567	462	452	2.3%	-115	-20%	-11	-2%	-	-
Romania	1 143	262	247	1.3%	-896	-78%	-15	-6%	T2	CS
Slovakia	498	35	35	0.2%	-462	-93%	0	1%	T2	CS
Slovenia	134	24	24	0.1%	-110	-82%	0	0%	T1	D
Spain	5 596	6 968	6 771	34.7%	1 175	21%	-197	-3%	T2	CS,D
Sweden	42	36	34	0.2%	-8	-20%	-2	-6%	T2	CS
EU-27	**25 385**	**20 425**	**19 507**	**100%**	**-5 878**	**-23%**	**-918**	**-4%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

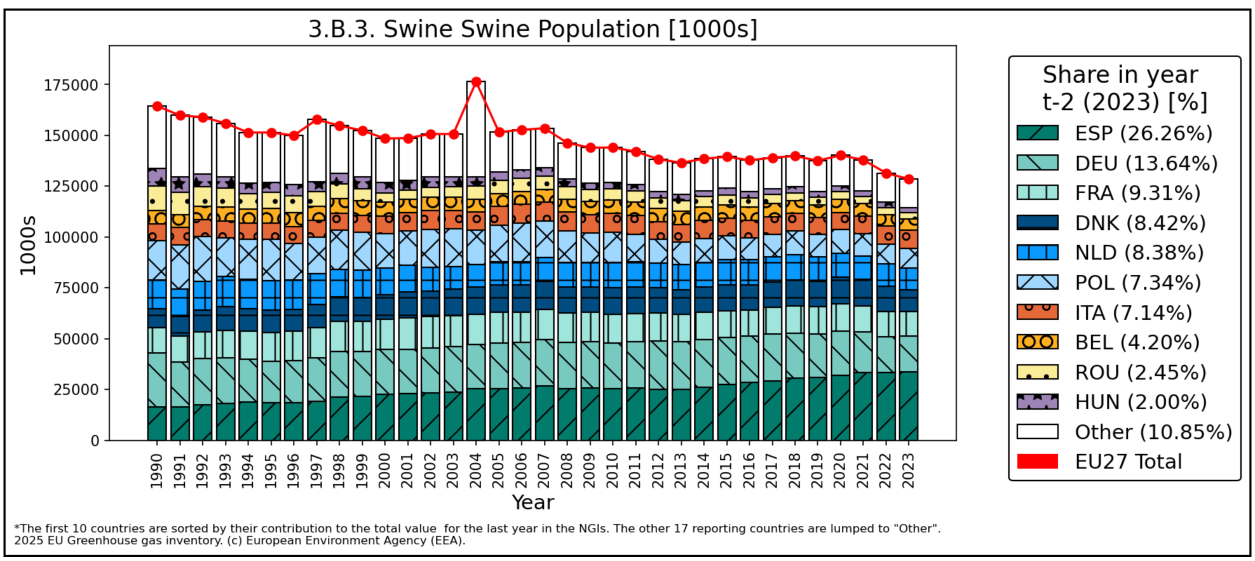
Figure 5.23 3.B.3: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B.3 - Swine - Population

The main activity data for CH_4 emissions from manure management - swine are the animal numbers. Swine population decreased considerably in the EU in the period 1990 to 2023. Figure 5.24 shows the trend of swine population indicating the countries contributing most to EU total.

Figure 5.24 3.B.3: Trend in swine population in the EU and the countries contributing most to EU values including their share to EU population in 2023



5.3.2.2 Implied EFs and methodological issues

In this section, we discuss the implied emission factor for category 3.B for the main animal types.

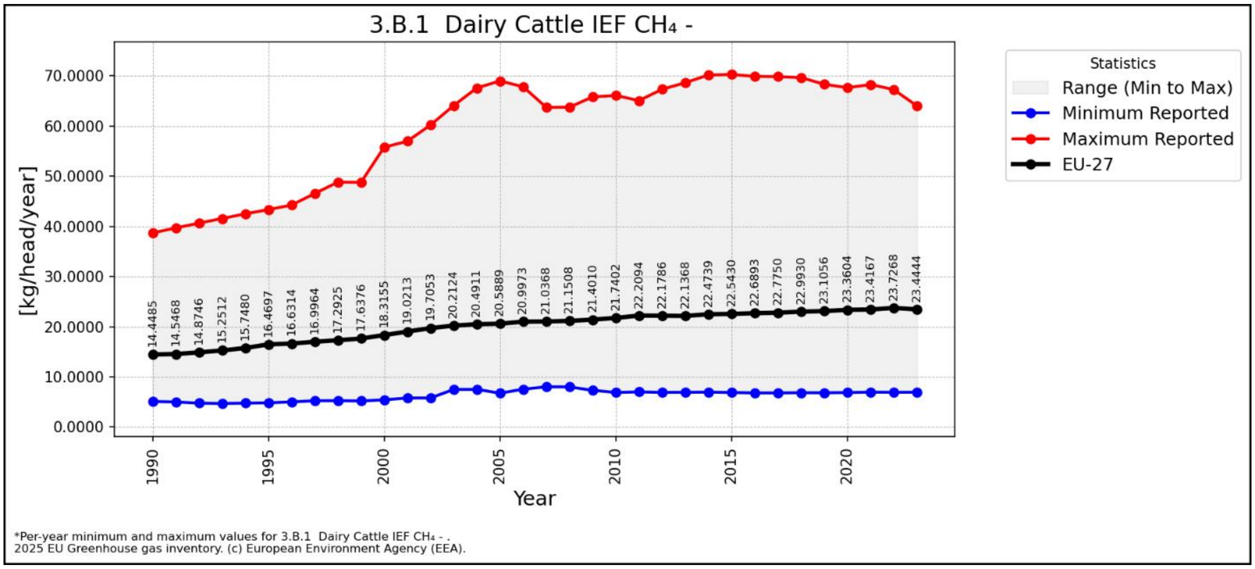
3.B.1 - Cattle - Implied emission factor

For cattle, the analysis is conducted per subcategory.

3.B.1.a - Dairy Cattle - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.B.1.a - Dairy Cattle* increased in the EU very strongly between 1990 and 2023. Figure 5.25 shows the trend of the implied emission factor indicating also the range of values used by the countries.

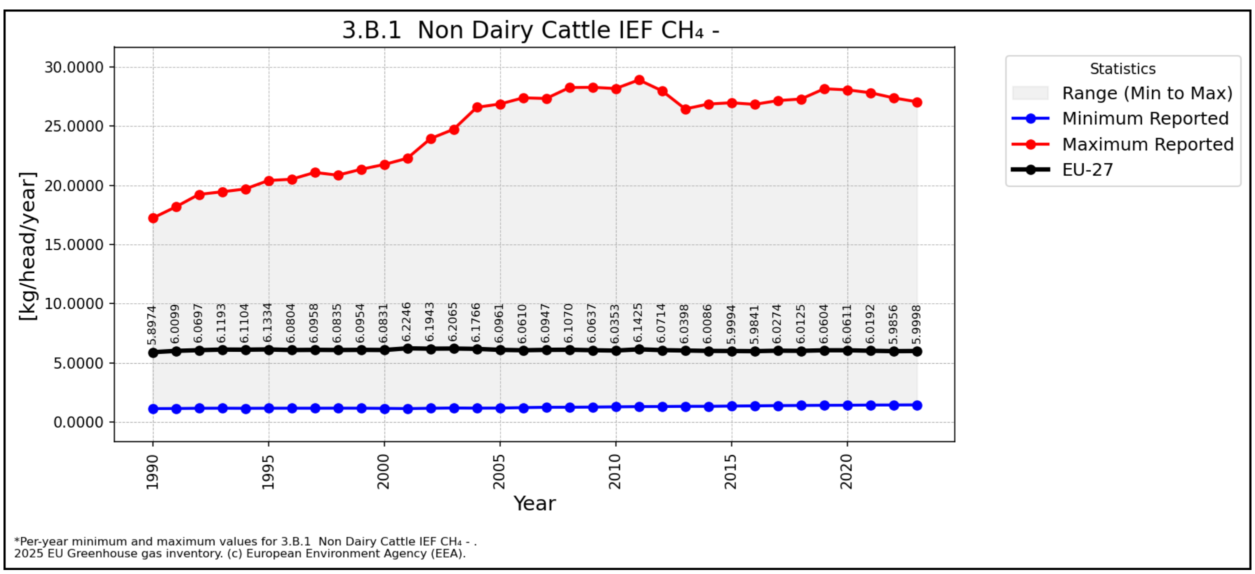
Figure 5.25 3.B 1.a - Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.B.1.b - Non-Dairy Cattle - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.B.1.b - Non-Dairy Cattle* remains quite stable between 1990 and 2023. Figure 5.26 shows the trend of the implied emission factor indicating also the range of values used by the countries.

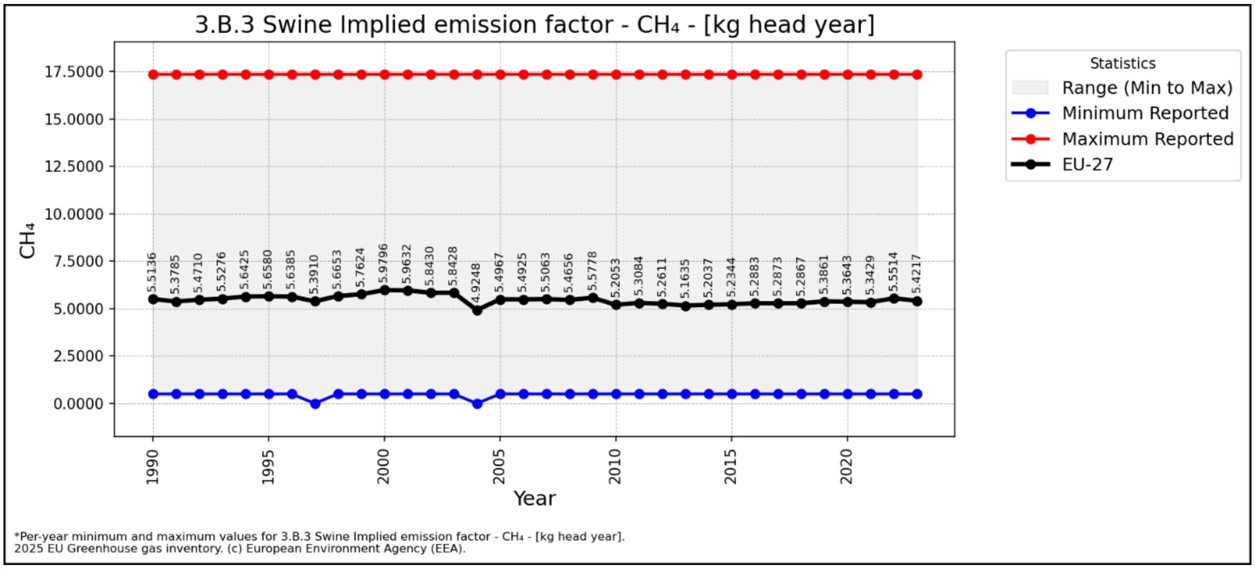
Figure 5.26 3.B.1.b - Non-Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.B. 3 - Swine - Implied emission factor

The implied emission factor for CH_4 emissions in source category *3.B.3 - Swine* decreased in the EU moderately between 1990 and 2023. Figure 5.27 shows the trend of the implied emission factor indicating also the range of values used by the countries.

Figure 5.27 3.B.3 - Swine: Trend in implied emission factor and range of values reported by countries



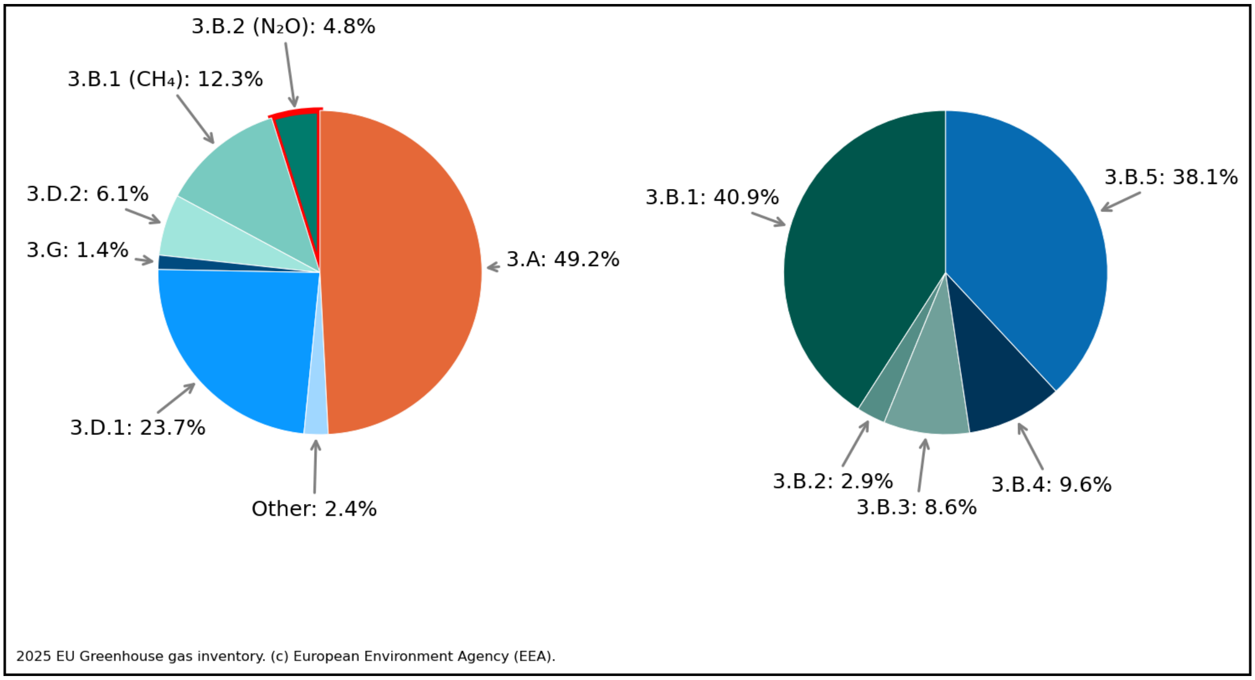
5.3.3 Manure Management - N_2O (CRT Source Category 3B)

In 2023 N_2O emissions in source category *3.B- Manure Management* in the EU were 17643 kt CO_2 equivalent. This corresponds to 0.61 % of total EU GHG emissions and 10 % of total EU N_2O emissions. They make 4.8 % of total agricultural emissions and 13.9 % of total agricultural N_2O emissions. The main sub-categories are Cattle (3.B.1) and Indirect Emissions (3.B.5), but substantial emissions are also reported for Swine (3.B.3) and Other Livestock (3.B.4), as presented in Figure 5.28.

Regarding the origin of emissions in the different countries, Figure 5.29 shows the distribution of N_2O emissions from manure management by subcategory in all countries. Each bar represents the total emissions of a country in the current emission category, where different shades of blue correspond to the subcategory.

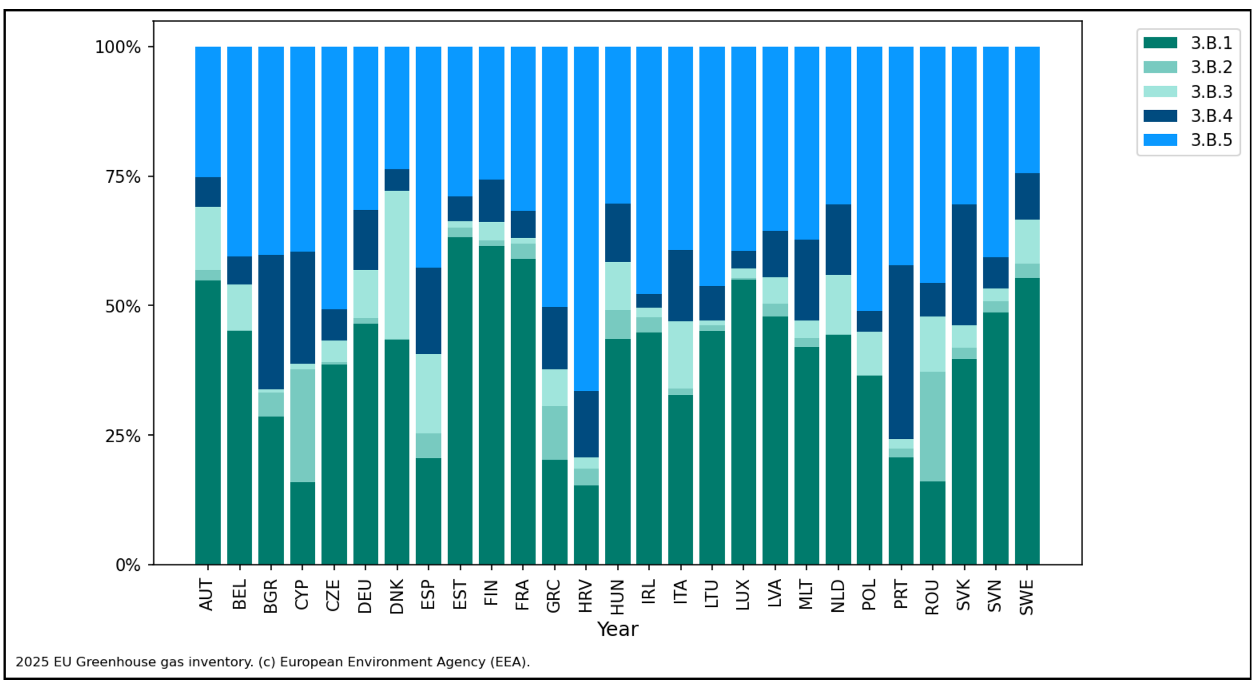
Figure 5.28 Share of source category 3.B-N_2O on total EU agricultural emissions (left panel) and decomposition into its sub-categories (right panel). The percentages refer to the emissions in the year 2022.3.B.1-

3.B.4: emissions by animal types (cattle, sheep, swine, other livestock); 3.B.5:Indirect emissions from manure management.



In the left panel, some minor differences in the numbers might be present due to automatic rounding of numbers.

Figure 5.29 Decomposition of N_2O emissions in source category 3.B.2 - Manure Management into its sub-categories by country in the year 2023.



N_2O emissions by country and for the total EU from 3.B *Manure Management* are shown in Table 5.10 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 35 % or 9.6 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.3 %.

Table 5.10 3.B - Manure Management: Countries' contributions to total EU-N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	657	477	462	2.6%	-196	-30%	-16	-3%	NA,T2	CS,D,NA
Belgium	551	402	394	2.2%	-158	-29%	-8	-2%	NA,T2	D,NA
Bulgaria	790	258	255	1.4%	-536	-68%	-4	-1%	T1,T2	D
Croatia	284	100	96	0.5%	-188	-66%	-4	-4%	T2	CS,D
Cyprus	59	68	68	0.4%	9	16%	0	-1%	T1	D
Czechia	975	381	378	2.1%	-597	-61%	-2	-1%	T1,T2	D
Denmark	919	567	506	2.9%	-414	-45%	-61	-11%	NA,T2	D,NA
Estonia	100	58	56	0.3%	-44	-44%	-2	-3%	NA,T1,T2	CS,D,NA
Finland	381	287	278	1.6%	-103	-27%	-9	-3%	NA,T2	D,NA
France	3 854	2 838	2 770	15.7%	-1 085	-28%	-69	-2%	T2	CS,D
Germany	4 494	3 005	3 002	17.0%	-1 492	-33%	-4	0%	NA,T2	CS,D,NA
Greece	335	263	268	1.5%	-67	-20%	5	2%	D,NA	D,NA
Hungary	758	367	351	2.0%	-407	-54%	-16	-4%	T1,T2	CS,D
Ireland	620	575	561	3.2%	-59	-9%	-14	-2%	NA,T2	CS,D,NA
Italy	2 518	1 677	1 698	9.6%	-820	-33%	21	1%	NA,T2	CS,D,NA
Latvia	252	66	61	0.3%	-190	-76%	-5	-7%	NA,T1,T2	D,NA
Lithuania	522	160	157	0.9%	-365	-70%	-2	-1%	NA,T1,T2	D,NA
Luxembourg	39	33	33	0.2%	-5	-14%	0	0%	NA,T2	CS,NA
Malta	17	11	12	0.1%	-5	-31%	0	2%	T1,T2	CS,D
Netherlands	837	652	644	3.6%	-194	-23%	-8	-1%	NA,T1	CS,NA
Poland	3 624	2 450	2 485	14.1%	-1 139	-31%	34	1%	NA,T1,T2	CS,D,NA
Portugal	239	202	201	1.1%	-38	-16%	-1	-1%	T2	CS,D
Romania	1 698	805	789	4.5%	-910	-54%	-16	-2%	NA,T1,T2	D,NA
Slovakia	561	208	208	1.2%	-353	-63%	-1	0%	T1,T2	CS
Slovenia	81	58	57	0.3%	-24	-30%	-1	-1%	T1,T2	CS,D
Spain	1 647	1 619	1 578	8.9%	-69	-4%	-41	-3%	T1,T2	D
Sweden	428	282	278	1.6%	-149	-35%	-4	-1%	CS,T2	CS,D
EU-27	**27 241**	**17 871**	**17 643**	**100%**	**-9 598**	**-35%**	**-227**	**-1%**	**-**	**-**

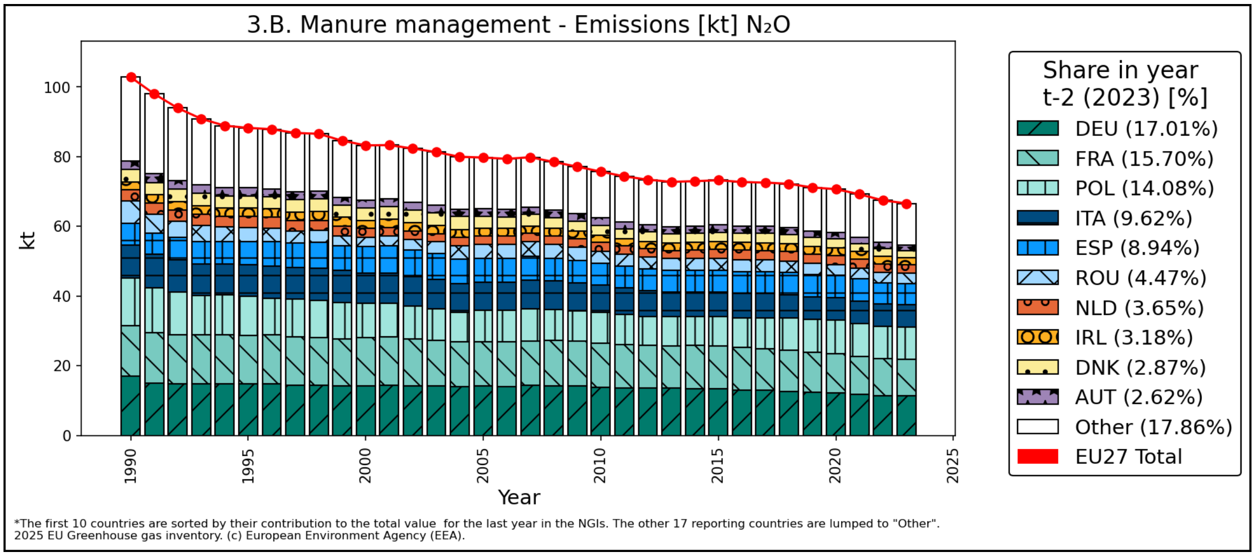
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

5.3.3.1 Trends in Emissions and Activity Data

3.B.- Manure Management - Emissions

N_2O Emissions in source category *3.B - Manure Management* decreased strongly in the EU in the period 1990 to 2023. Figure 5.30 shows the trend of emissions indicating the countries contributing most to EU total.

Figure 5.30 3.B Manure Management: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B. 1 - Cattle - Emissions

In 2023 N_2O emissions in source category *3.B.1 - Cattle* in the EU were 7221 kt CO_2 equivalent. It represents 2 % of total agricultural emissions and 5.7 % of total agricultural N_2O emissions. Figure 5.31 and Figure 5.32 show the trend of emissions indicating the countries contributing most to the EU total.

N_2O emissions by country and for the total EU from 3.B.1 *Manure Management* are shown in Table 5.11 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 35 % or 4.0 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.2 %.

Table 5.11 3.B.1 - Cattle: Countries' contributions to total EU-N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	404	265	253	3.5%	-150	-37%	-12	-4%	T2	D
Belgium	273	178	178	2.5%	-96	-35%	0	0%	T2	D
Bulgaria	189	76	73	1.0%	-116	-61%	-3	-4%	T2	D
Croatia	80	15	15	0.2%	-65	-82%	-1	-4%	T2	CS,D
Cyprus	7	11	11	0.1%	3	46%	0	1%	T1	D
Czechia	370	147	146	2.0%	-224	-61%	0	0%	T2	D
Denmark	280	236	219	3.0%	-61	-22%	-17	-7%	T2	D
Estonia	54	38	36	0.5%	-18	-34%	-2	-5%	T2	CS,D
Finland	220	176	171	2.4%	-49	-22%	-5	-3%	T2	D
France	2 290	1 675	1 637	22.7%	-653	-29%	-39	-2%	T2	CS,D
Germany	2 199	1 400	1 398	19.4%	-800	-36%	-2	0%	T2	CS,D
Greece	78	54	54	0.8%	-24	-31%	0	0%	D	D
Hungary	248	159	153	2.1%	-95	-38%	-6	-4%	T2	CS
Ireland	298	259	251	3.5%	-47	-16%	-7	-3%	T2	CS,D
Italy	1 067	557	556	7.7%	-511	-48%	-1	0%	T2	CS,D
Latvia	107	32	29	0.4%	-78	-73%	-2	-8%	T2	D
Lithuania	186	71	71	1.0%	-115	-62%	0	0%	T2	D
Luxembourg	23	18	18	0.3%	-5	-21%	0	1%	T2	CS
Malta	8	5	5	0.1%	-3	-40%	0	-2%	T2	CS
Netherlands	305	281	285	4.0%	-20	-7%	4	1%	T1	CS
Poland	1 255	892	905	12.5%	-350	-28%	13	1%	NA,T2	CS,NA
Portugal	70	43	42	0.6%	-28	-40%	-1	-2%	T2	CS
Romania	294	128	126	1.7%	-167	-57%	-1	-1%	T2	D
Slovakia	262	85	82	1.1%	-179	-69%	-2	-3%	T2	CS
Slovenia	33	28	28	0.4%	-5	-16%	0	-1%	T1,T2	CS,D
Spain	325	327	324	4.5%	0	0%	-3	-1%	T2	D
Sweden	251	154	154	2.1%	-97	-39%	0	0%	CS,T2	CS,D
EU-27	**11 177**	**7 308**	**7 221**	**100%**	**-3 956**	**-35%**	**-87**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.31 3.B.1.a - Dairy cattle: Trend in N_2O emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023

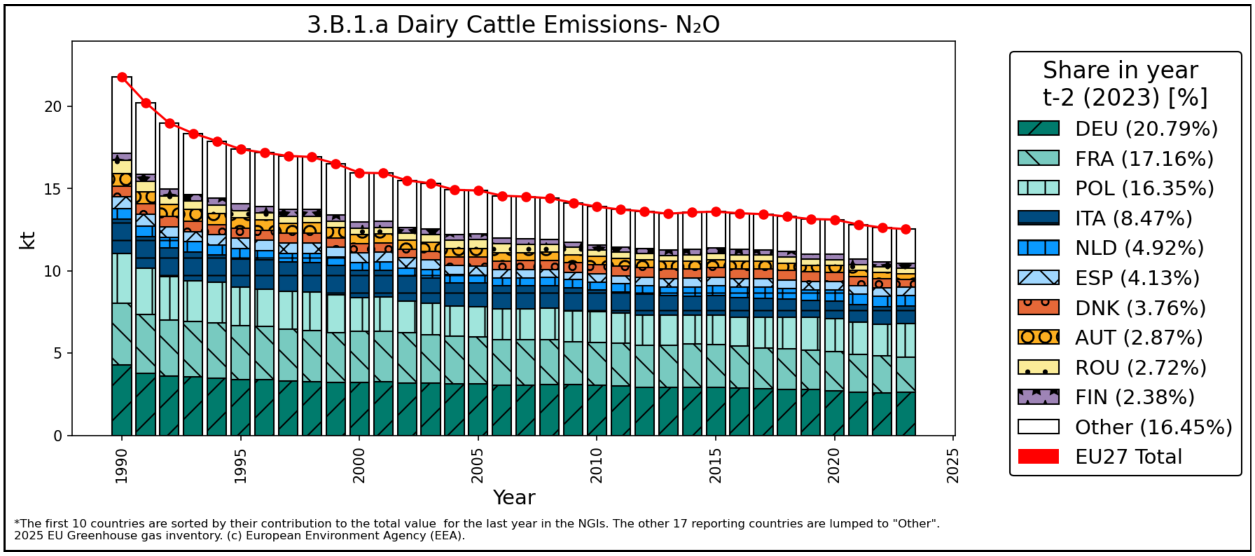
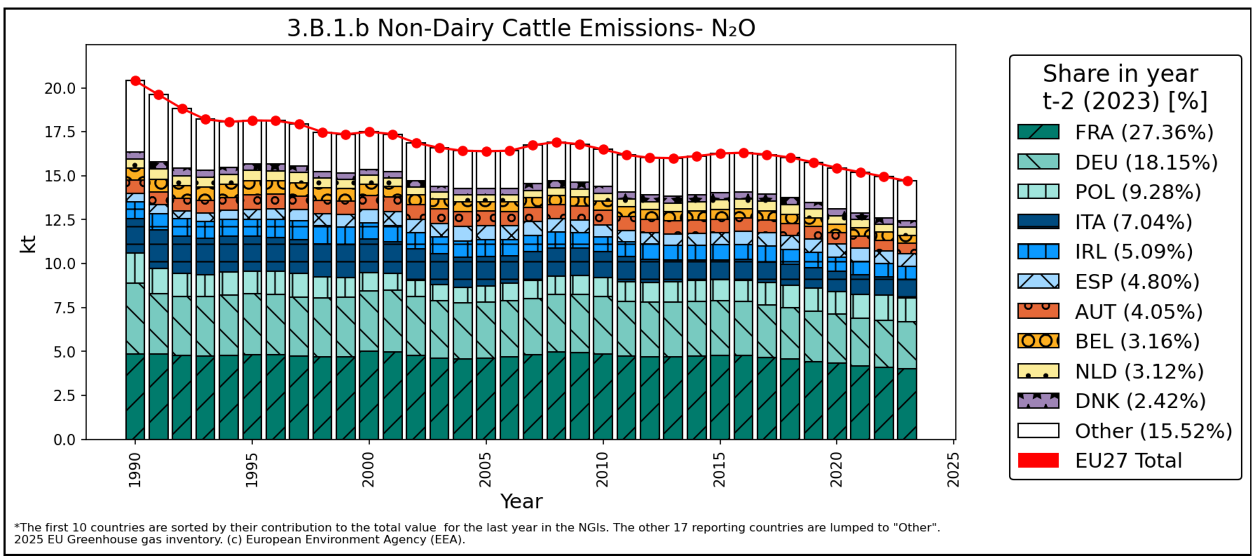


Figure 5.32 3.B.1.b - Non-dairy cattle: Trend in N_2O emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B. 1 - Cattle - population

One of the main activity data for N_2O emissions from manure management - cattle is the animal numbers. Cattle numbers are already discussed under source category 3.A Enteric Fermentation and therefore not further discussed here. Other relevant activity data are the allocation by manure management system (MMS).

3.B.3 - Swine - Emissions

In 2023 N_2O emissions in source category *3.B.3 - Swine* in the EU were 1514 kt CO_2 equivalent. It represents 0.4% of total agricultural emissions and 1.2% of total agricultural N_2O emissions. Figure 5.33 shows the trend of emissions indicating the countries contributing most to the EU total.

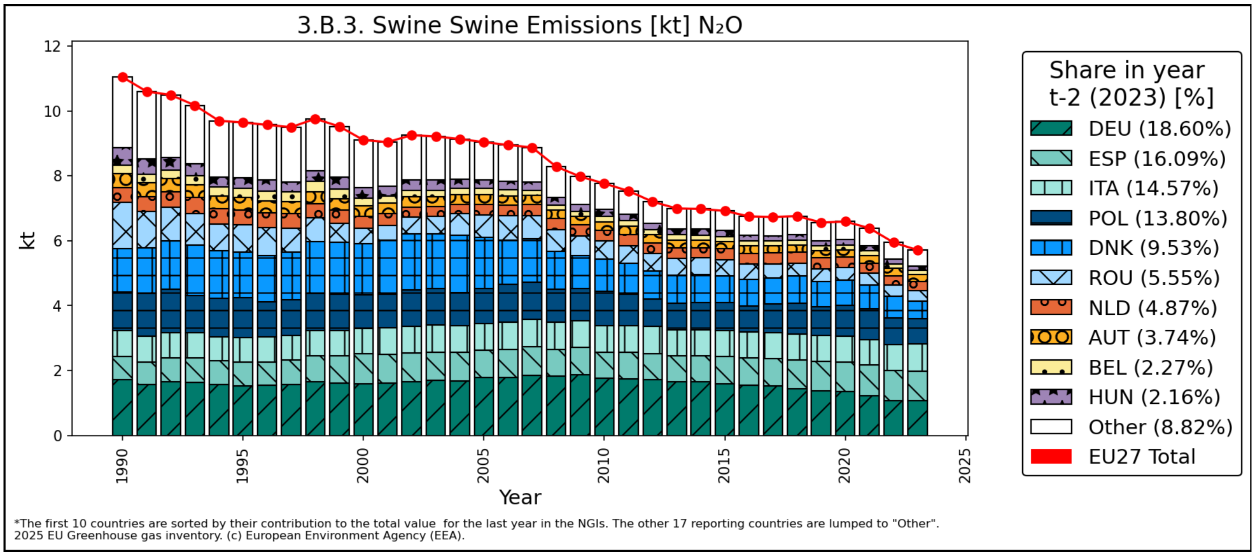
Total N_2O emissions by country and for the total EU from 3.B.3 *Manure Management* are shown in Table 5.12 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 48 % or 1.4 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 4.0 %.

Table 5.12 3.B.3 - Swine: Countries' contributions to total EU-N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	111	59	57	3.7%	-54	-49%	-2	-3%	T2	D
Belgium	72	37	34	2.3%	-38	-52%	-2	-6%	T2	D
Bulgaria	9	1	1	0.1%	-7	-85%	0	3%	T2	D
Croatia	25	2	2	0.1%	-22	-91%	0	-9%	T2	CS,D
Cyprus	1	1	1	0.0%	0	4%	0	-6%	T1	D
Czechia	113	15	15	1.0%	-97	-86%	0	2%	T1,T2	D
Denmark	355	177	144	9.5%	-210	-59%	-33	-19%	T2	D
Estonia	2	1	1	0.0%	-1	-66%	0	8%	T2	CS,D
Finland	38	10	10	0.7%	-28	-73%	0	-2%	T2	D
France	78	31	30	2.0%	-48	-61%	-1	-3%	T2	CS,D
Germany	457	284	282	18.6%	-175	-38%	-2	-1%	T2	CS,D
Greece	28	19	19	1.2%	-9	-33%	0	-2%	D	D
Hungary	141	38	33	2.2%	-108	-77%	-5	-14%	T2	CS
Ireland	9	11	11	0.7%	2	21%	0	-3%	T2	CS,D
Italy	210	212	220	14.6%	10	5%	8	4%	T2	CS,D
Latvia	36	3	3	0.2%	-33	-92%	0	-11%	T2	D
Lithuania	98	1	1	0.1%	-97	-99%	0	-11%	T2	D
Luxembourg	1	1	1	0.0%	0	-46%	0	-5%	T2	CS
Malta	1	0	0	0.0%	-1	-65%	0	17%	T1	D
Netherlands	125	79	74	4.9%	-51	-41%	-5	-7%	T1	CS
Poland	314	215	209	13.8%	-105	-33%	-6	-3%	T2	CS
Portugal	10	4	4	0.2%	-6	-62%	0	-2%	-	-
Romania	375	90	84	5.5%	-291	-78%	-6	-7%	T2	D
Slovakia	66	9	9	0.6%	-57	-86%	0	1%	T2	CS
Slovenia	6	1	1	0.1%	-5	-78%	0	-1%	T1	D
Spain	191	247	243	16.1%	53	28%	-3	-1%	T2	D
Sweden	57	26	24	1.6%	-33	-58%	-2	-8%	CS,T2	CS,D
EU-27	**2 926**	**1 576**	**1 514**	**100%**	**-1 412**	**-48%**	**-62**	**-4%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.33 3.B.3 - Swine: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B. 4 - Other Livestock - Emissions

In 2023 N_2O emissions in source category *3.B.4 - Other Livestock* in the EU were 1685 kt CO_2 equivalent. It represents 0.5 % of total agricultural emissions and 1.3 % of total agricultural N_2O emissions.

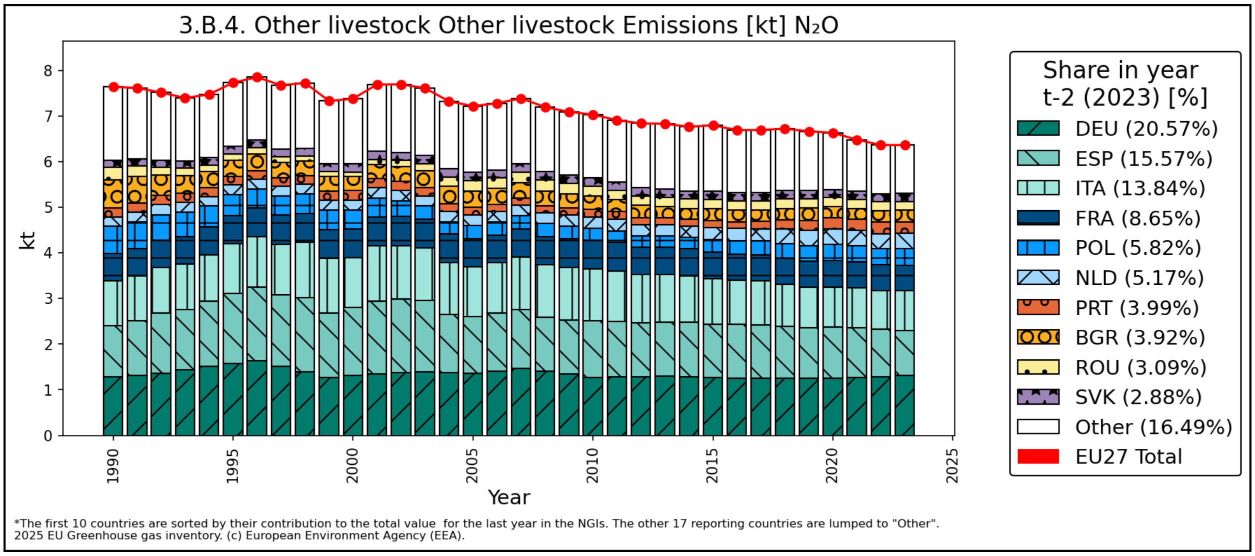
Total N_2O emissions by country and for the total EU from 3.B.4 *Manure Management* are shown in Table 5.13 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 17 % or 338 kt CO_2-eq. From 2022 to 2023 emissions in the current category remained stable. Figure 5.34 shows the trend of emissions indicating the countries contributing most to EU total.

Table 5.13 3.B.4 - Other Livestock: Countries' contributions to total EU-N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	11	26	26	1.5%	15	127%	0	1%	NA,T2	D,NA
Belgium	8	21	21	1.3%	13	153%	0	2%	NA,T2	D,NA
Bulgaria	164	65	66	3.9%	-98	-60%	1	1%	T1,T2	D
Croatia	29	12	12	0.7%	-17	-58%	0	4%	T2	CS,D
Cyprus	15	15	15	0.9%	-1	-3%	-1	-4%	T1	D
Czechia	55	25	23	1.4%	-32	-58%	-2	-7%	T1,T2	D
Denmark	40	21	21	1.3%	-19	-48%	0	0%	NA,T2	D,NA
Estonia	11	3	3	0.2%	-9	-76%	0	3%	NA,T1	D,NA
Finland	30	24	23	1.3%	-7	-25%	-1	-5%	NA,T2	D,NA
France	157	149	146	8.7%	-11	-7%	-3	-2%	T2	CS,D
Germany	339	340	347	20.6%	7	2%	6	2%	NA	NA
Greece	53	30	33	1.9%	-20	-38%	2	7%	D,NA	D,NA
Hungary	92	41	39	2.3%	-52	-57%	-2	-5%	T1,T2	CS,D
Ireland	16	15	15	0.9%	-1	-7%	-1	-4%	NA,T2	CS,D,NA
Italy	260	225	233	13.8%	-27	-10%	8	4%	NA,T2	CS,D,NA
Latvia	18	6	6	0.3%	-12	-69%	0	-6%	NA,T1,T2	D,NA
Lithuania	14	11	10	0.6%	-4	-27%	0	-4%	NA,T1	D,NA
Luxembourg	0	1	1	0.1%	1	140%	0	-6%	NA,T2	CS,NA
Malta	1	2	2	0.1%	1	111%	0	11%	T1	CS,D
Netherlands	54	88	87	5.2%	33	62%	0	0%	NA,T1	CS,NA
Poland	158	94	98	5.8%	-60	-38%	4	5%	T1,T2	CS,D
Portugal	53	67	67	4.0%	14	26%	0	1%	T2	CS,D
Romania	71	54	52	3.1%	-19	-27%	-2	-3%	NA,T1,T2	D,NA
Slovakia	43	47	49	2.9%	6	14%	2	4%	T1,T2	CS
Slovenia	4	3	3	0.2%	0	-3%	0	0%	T1	D
Spain	299	276	262	15.6%	-37	-12%	-13	-5%	T1,T2	D
Sweden	26	26	25	1.5%	-1	-4%	-1	-3%	T2	D
EU-27	**2 023**	**1 686**	**1 685**	**100%**	**-338**	**-17%**	**0**	**0%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.34 3.B.4 - Other Livestock: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.B.5 - Manure Management - Indirect Emissions - Emissions

In 2023 N_2O emissions in source category *3.B.5 - Manure Management - Indirect Emissions - Indirect N_2O emissions* in the EU were 6716 kt CO_2 equivalent. It represents 1.8 % of total agricultural emissions and 5.3 % of total agricultural N_2O emissions. Those emissions include emissions from atmospheric deposition and leaching and run-off.

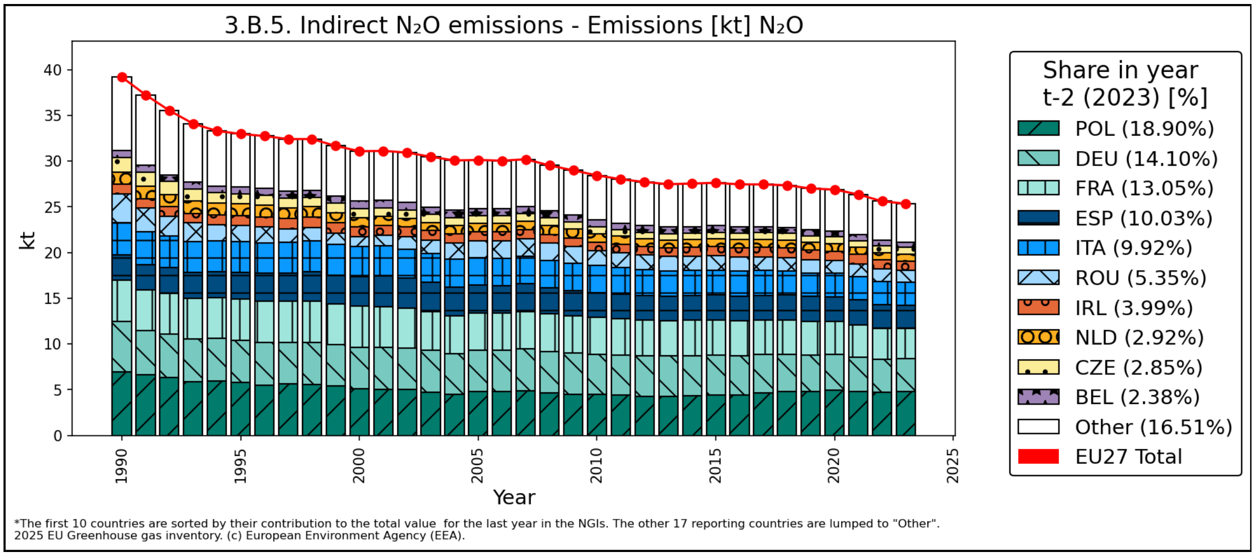
Total N_2O emissions by country and for the total EU from 3.B.5 *Manure Management - Indirect Emissions* are shown in Table 5.14 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 35 % or 3.7 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.0 %. Figure 5.35 shows the trend of emissions indicating the countries contributing most to EU total.

Table 5.14 3.B.5 - Manure Management - Indirect Emissions: Countries' contributions to total EU- N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	123	119	117	1.7%	-7	-6%	-2	-2%	T2	D
Belgium	196	166	160	2.4%	-36	-18%	-6	-4%	T1	D
Bulgaria	343	104	103	1.5%	-240	-70%	-1	-1%	T1	D
Croatia	147	67	64	1.0%	-83	-57%	-3	-5%	T1	D
Cyprus	23	27	27	0.4%	4	17%	0	-1%	T1	D
Czechia	432	192	191	2.9%	-241	-56%	-1	0%	T1,T2	D
Denmark	243	131	120	1.8%	-123	-51%	-11	-9%	T2	D
Estonia	30	16	16	0.2%	-14	-46%	0	-1%	T2	CS,D
Finland	91	74	71	1.1%	-19	-21%	-2	-3%	T2	D
France	1 196	902	876	13.0%	-320	-27%	-26	-3%	-	-
Germany	1 448	953	947	14.1%	-502	-35%	-6	-1%	-	-
Greece	149	131	134	2.0%	-15	-10%	3	2%	D	D
Hungary	248	110	106	1.6%	-142	-57%	-4	-3%	T1,T2	CS,D
Ireland	273	273	268	4.0%	-5	-2%	-5	-2%	T1	D
Italy	951	660	666	9.9%	-285	-30%	6	1%	T2	CS,D
Latvia	86	23	22	0.3%	-65	-75%	-1	-6%	CS	D
Lithuania	223	74	73	1.1%	-150	-67%	-1	-2%	T1	D
Luxembourg	14	13	13	0.2%	-1	-5%	0	0%	T2	D
Malta	7	4	4	0.1%	-2	-34%	0	2%	T1	D
Netherlands	347	203	196	2.9%	-151	-43%	-7	-3%	CS	CS
Poland	1 848	1 246	1 269	18.9%	-578	-31%	23	2%	T1	D
Portugal	96	85	85	1.3%	-11	-11%	-1	-1%	-	-
Romania	828	367	359	5.4%	-468	-57%	-7	-2%	T1	D
Slovakia	181	63	63	0.9%	-118	-65%	0	0%	T1	D
Slovenia	38	24	23	0.3%	-15	-39%	0	-1%	T1	D
Spain	733	689	673	10.0%	-60	-8%	-16	-2%	T2	D
Sweden	89	69	68	1.0%	-21	-24%	-1	-1%	-	-

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.35   3.B.5 - Manure Management - Indirect Emissions: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



5.3.3.2 Implied EFs and Methodological Issues

In this section, we discuss the implied emission factor for the main animal types. Furthermore, we present data on the nitrogen excretion rate for the different animal types.

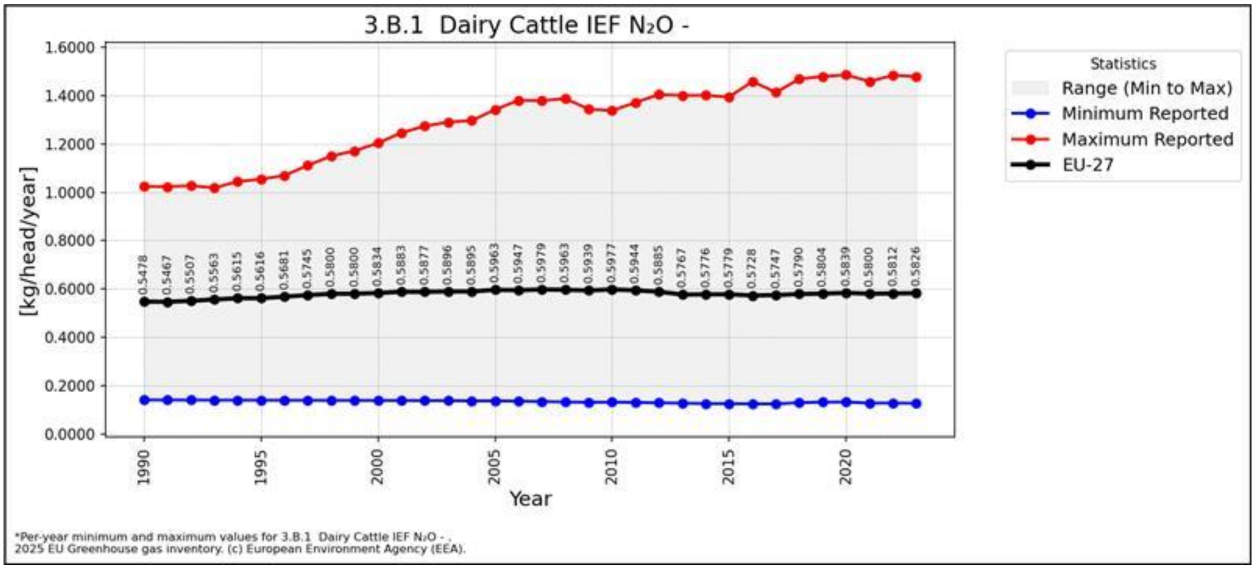
3.B.1 - Cattle - Implied emission factor

For cattle, the analysis is conducted per subcategory.

3.B.1.a - Dairy Cattle - Implied emission factor

The implied emission factor for N_2O emissions in source category *3.B.1.a - Dairy Cattle* increased in the EU clearly between 1990 and 2023. Figure 5.36 shows the trend of the implied emission factor indicating also the range of values used by the countries. This increase is mainly explained by the increase in the nitrogen excreted per head.

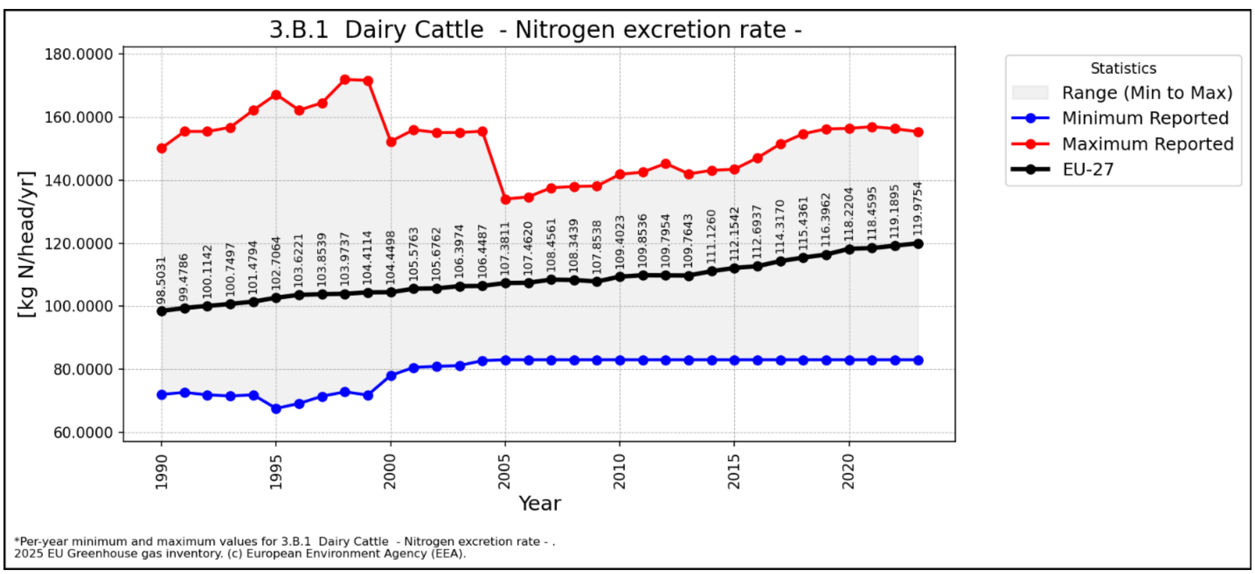
Figure 5.36 3.B.1.a - Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.B.1.a - Dairy Cattle - Nitrogen excretion rate

The nitrogen excretion rate, a parameter used for calculating N_2O emissions in source category *3.B.1.1 - Dairy Cattle*, increased in the EU considerably between 1990 and 2023. Figure 5.37 shows the trend of the nitrogen excretion rate indicating also the range of values used by the countries.

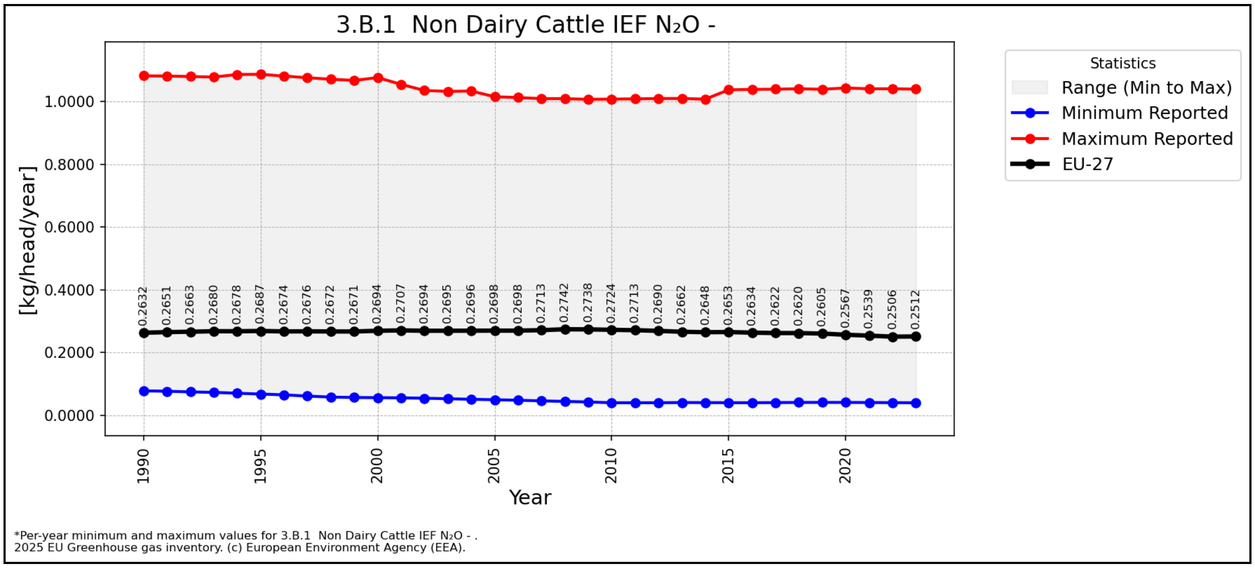
Figure 5.37 3.B.1.a - Dairy Cattle: Trend in nitrogen excretion rate and range of values reported by countries



3.B.1.b - Non-Dairy Cattle - Implied emission factor

The implied emission factor for N_2O emissions in source category *3.B.1.b - Non-Dairy Cattle* decreased slightly in the EU between 1990 and 2023. Figure 5.38 shows the trend of the implied emission factor indicating also the range of values used by the countries. As mentioned for dairy cattle, one of the main drivers involved in the implied emission factor is the nitrogen excretion rate.

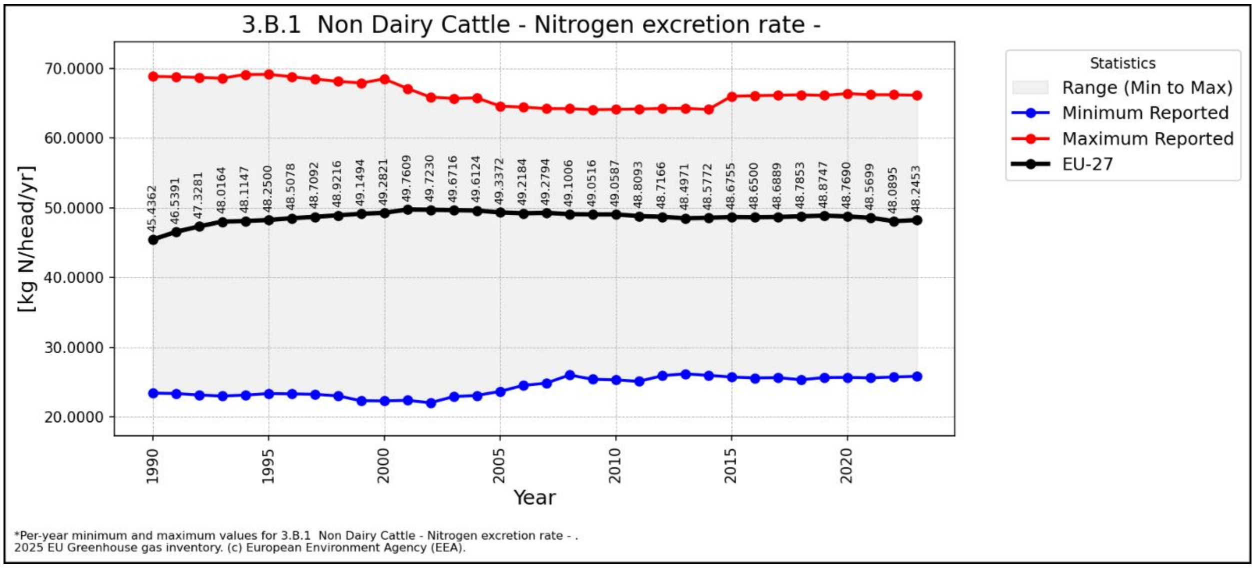
Figure 5.38 3.B.1.b - Non-Dairy Cattle: Trend in implied emission factor and range of values reported by countries



3.B.1.b - Non-Dairy Cattle - Nitrogen excretion rate

The nitrogen excretion rate, a parameter used for calculating N_2O emissions in source category *3.B.1.b - Non-Dairy Cattle*, increased in the EU moderately between 1990 and 2023. Figure 5.39 shows the trend of the nitrogen excretion rate indicating also the range of values used by the countries.

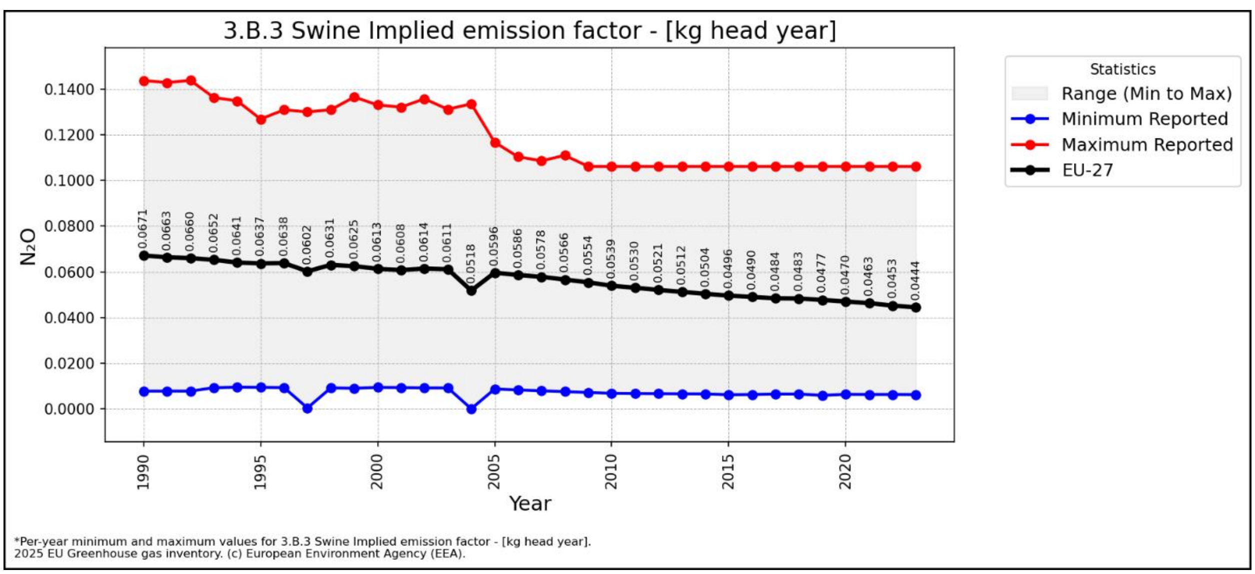
Figure 5.39 3.B.1.b - Non-Dairy Cattle: Trend in nitrogen excretion rate and range of values reported by countries



3.B.3 - Swine - Implied emission factor

The implied emission factor for N_2O emissions in source category *3.B.3 - Swine* decreased in the EU between 1990 and 2023. Figure 5.40 shows the trend of the implied emission factor indicating also the range of values used by the countries.

Figure 5.40 3.B.3 - Swine: Trend in implied emission factor and range of values reported by countries

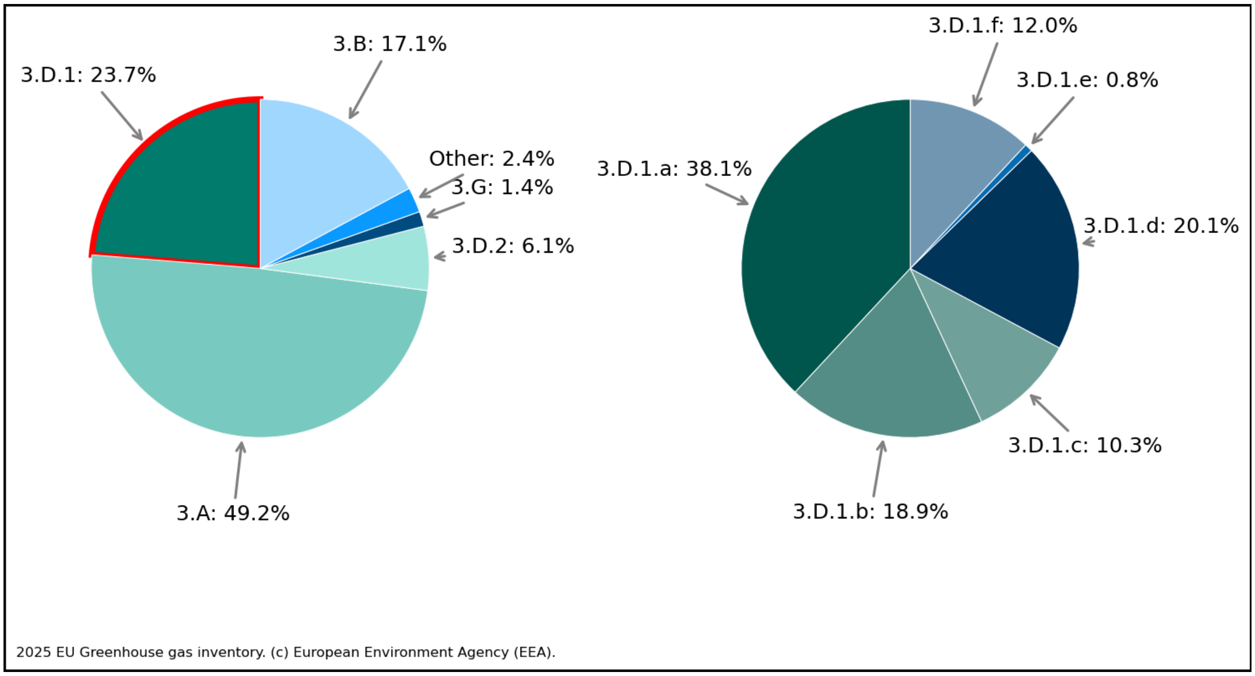


5.3.4 Direct Emissions from Managed Soils - N_2O (CRT Source Category 3D1)

In 2023 N_2O emissions in source category *3.D.1 - Direct N_2O Emissions From Managed Soils* in the EU were 86551 kt CO_2 equivalent. This corresponds to 3.0 % of total EU GHG emissions and 49.1 % of total

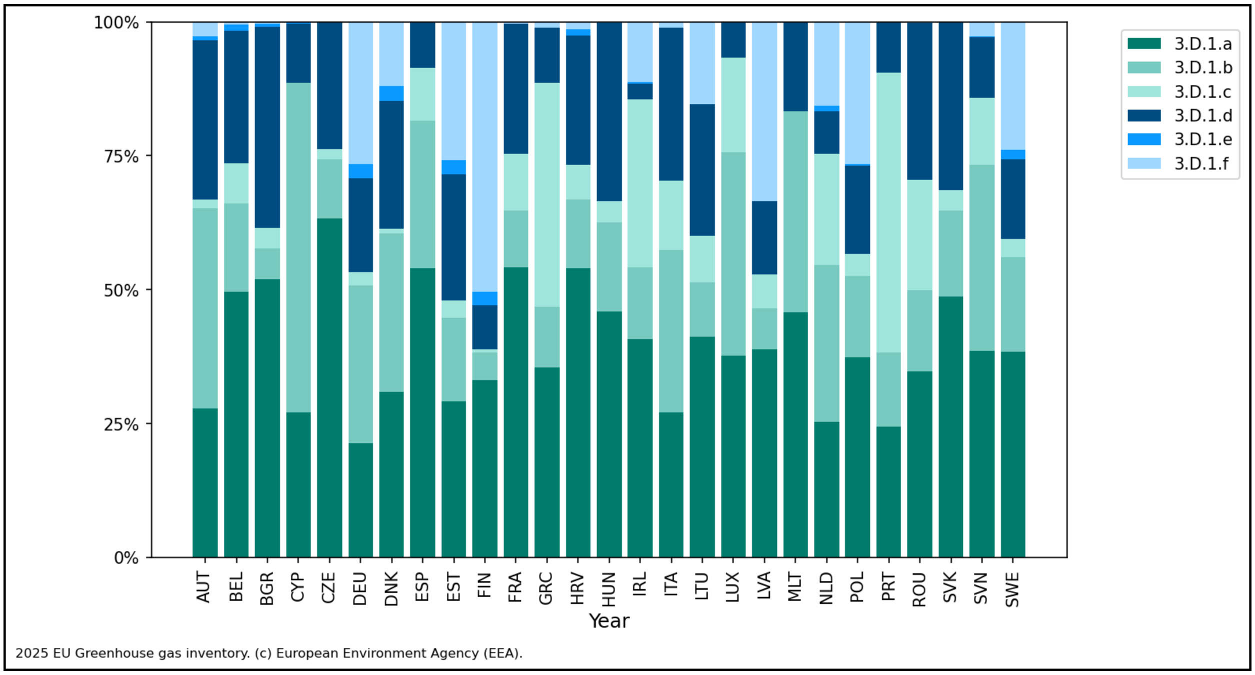
EU N_2O emissions. They make 23.7 % of total agricultural emissions and 68.2 % of total agricultural N_2O emissions. The main sub-categories are 3.D.1.a (Inorganic N Fertilizers), 3.D.1.b (Organic N Fertilizers) and 3.D.1.d (Crop Residues) as shown in Figure 5.41. Regarding the origin of emissions in the different countries, Figure 5.42 shows the distribution of direct N_2O emissions from managed soils by emission source in all countries. Each bar represents the total emissions of a country in the current emission category, where different shades of blue correspond to the emitting sub-categories.

Figure 5.41 Share of source category 3.D.1 on total EU agricultural emissions (left panel) and decomposition into its sub-categories (right panel). The percentages refer to the emissions in the year 2022. Categories 3.D.1.a-3.D.1.e: direct N_2O emissions by N source (inorganic fertilizers, organic fertilizers, urine and dung deposited by grazing animals, crop residues and mineralization of soil organic matter); category 3.D.1.f: cultivation of histosols.



In the left panel, some minor differences in the numbers might be present due to automatic rounding of numbers.

Figure 5.42 Decomposition of emissions in source category 3.D.1 - Direct N_2O Emissions From Managed Soils into its sub-categories by country in the year 2022. 3.D.1.a inorganic N fertilizers, 3.D.1.b organic N fertilizers, 3.D.1.c urine and dung deposited by grazing animals, 3.D.1.d crop residues incorporated in the soil, 3.D.1.e mineralisation/immobilisation associated with loss/gain of soil organic matter, and 3.D.1.f cultivation of organic soils (histosols).



Total N_2O emissions by country and for the total EU from 3.D.1 *Direct N_2O Emissions From Managed Soils* are shown in Table 5.15 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 23.5 % or 26.7 Mt CO_2-eq. From 2022 to 2023 emissions in the current category increased by 1.0 %.

Table 5.15 3.D.1 - Direct N_2O Emissions From Managed Soils: Countries' contributions to total EU- N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	1 606	1 438	1 402	1.6%	-204	-13%	-36	-2%
Belgium	2 518	1 618	1 726	2.0%	-792	-31%	108	7%
Bulgaria	3 627	2 688	2 734	3.2%	-893	-25%	46	2%
Croatia	952	675	670	0.8%	-282	-30%	-5	-1%
Cyprus	40	34	34	0.0%	-7	-16%	0	-1%
Czechia	2 184	1 666	1 617	1.9%	-567	-26%	-49	-3%
Denmark	4 161	3 031	2 664	3.1%	-1 497	-36%	-367	-12%
Estonia	810	576	549	0.6%	-261	-32%	-27	-5%
Finland	3 141	2 593	2 830	3.3%	-310	-10%	237	9%
France	17 711	13 746	13 879	16.0%	-3 832	-22%	133	1%
Germany	14 885	12 706	12 278	14.2%	-2 607	-18%	-428	-3%
Greece	3 320	1 978	1 985	2.3%	-1 335	-40%	7	0%
Hungary	3 086	2 412	2 407	2.8%	-679	-22%	-6	0%
Ireland	3 635	3 530	3 155	3.6%	-480	-13%	-375	-11%
Italy	7 984	6 422	7 285	8.4%	-699	-9%	863	13%
Latvia	1 436	894	861	1.0%	-575	-40%	-32	-4%
Lithuania	2 079	1 335	1 289	1.5%	-790	-38%	-46	-3%
Luxembourg	124	83	88	0.1%	-36	-29%	5	6%
Malta	17	20	19	0.0%	2	13%	-1	-6%
Netherlands	6 348	3 618	3 704	4.3%	-2 643	-42%	86	2%
Poland	14 753	11 109	11 563	13.4%	-3 190	-22%	454	4%
Portugal	1 600	1 425	1 481	1.7%	-119	-7%	56	4%
Romania	9 113	5 470	5 549	6.4%	-3 564	-39%	78	1%
Slovakia	802	447	461	0.5%	-341	-43%	14	3%
Slovenia	293	278	270	0.3%	-23	-8%	-9	-3%
Spain	4 547	4 004	4 056	4.7%	-492	-11%	51	1%
Sweden	2 437	2 091	1 994	2.3%	-442	-18%	-96	-5%
EU-27	**113 209**	**85 890**	**86 551**	**100%**	**-26 658**	**-24%**	**662**	**1%**

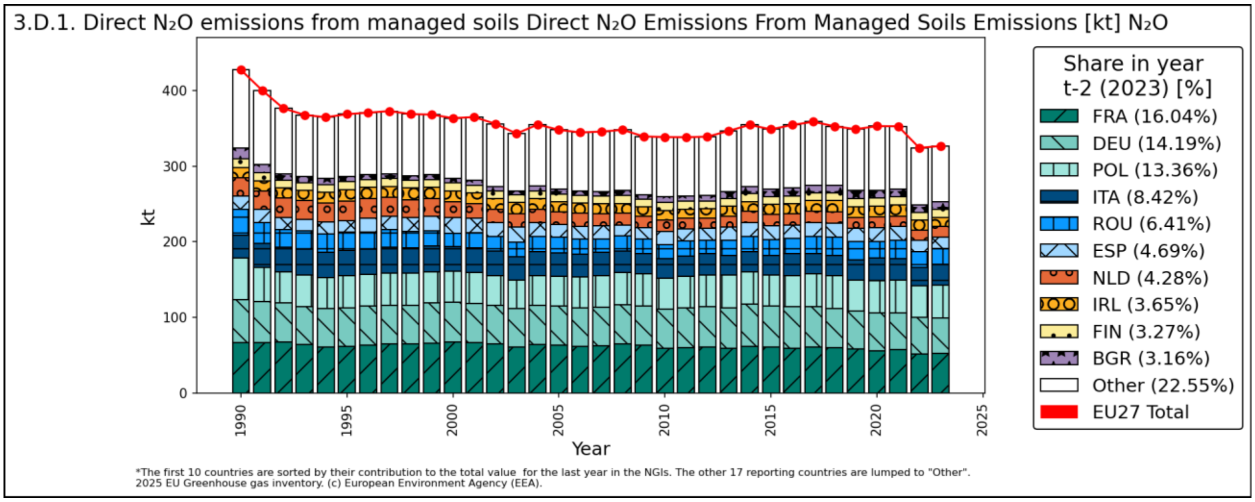
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

5.3.4.1 Trends in Emissions and Activity Data

3.D.1 - Direct N_2O Emissions From Managed Soils - Emissions

Emissions in source category *3.D.1 - Direct N_2O Emissions From Managed Soils* decreased considerably in the EU in the period 1990 to 2023. Figure 5.43 shows the trend of emissions indicating the countries contributing most to EU total.

Figure 5.43 3.D.1 Direct N_2O Emissions From Managed Soils: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



The main driving forces of direct N_2O emissions from agricultural soils are the use of nitrogen fertiliser and animal manure. N_2O emissions from agricultural land can be decreased by overall efficiency improvements of nitrogen uptake by crops, which should lead to lower fertiliser consumption on agricultural land. The decrease of fertiliser use is partly due to the effects of the 1992 reform of the Common Agricultural Policy and the resulting shift from production-based support mechanisms to direct area payments in arable production. This has tended to lead to an optimisation and overall reduction in fertiliser use. In addition, reduction in fertiliser use is also due to directives such as the Nitrate Directive and to the extensification measures included in the Agro-Environment Programmes (EC, 2001).

Another policy affecting GHG emissions, in this case through the application of sewage sludge, is the Urban Wastewater Treatment Directive[42].

3.D.1.a - Direct N_2O emissions from inorganic N fertilizers - Emissions

Emissions in source category *3.D.1.a - Direct N_2O Emissions From Inorganic N fertilizers* decreased considerably in the EU by 35 % or 17.6 Mt CO_2-eq in the period 1990 to 2023. Figure 5.44 shows the trend of emissions indicating the countries contributing most to EU total. N_2O emissions by country and for the total EU from *3.D.1.a Direct N_2O Emissions From Inorganic N fertilizers* are shown in Table 5.16 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. From 2022 to 2023 emissions in the current category increased by 0.9 %.

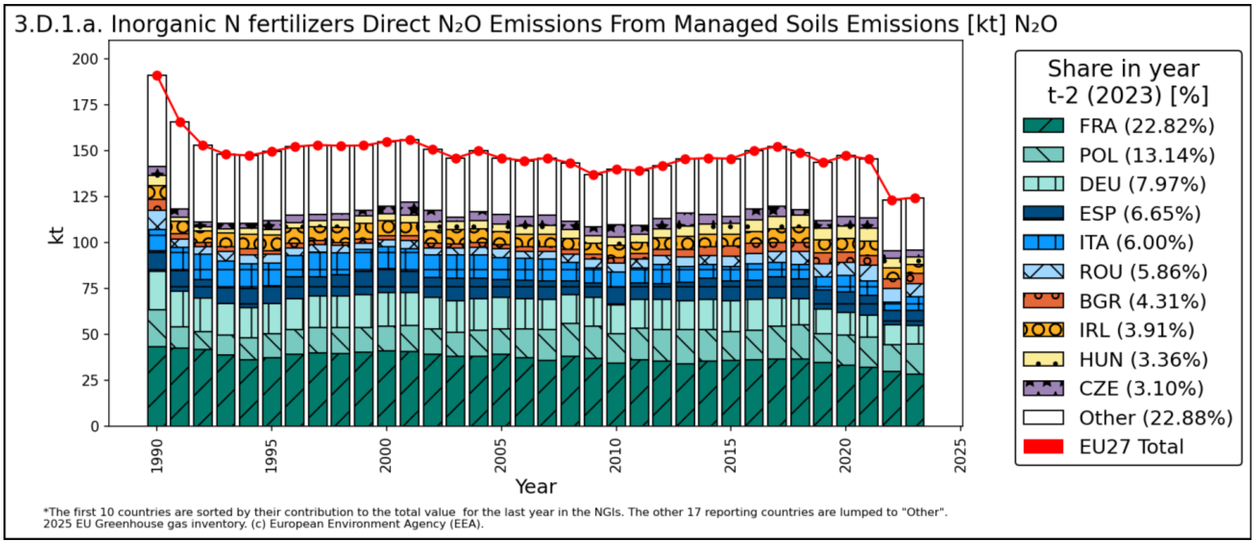
42 http://ec.europa.eu/environment/water/water-urbanwaste/legislation/directive_en.htm

Table 5.16 3.D.1.a - Direct N_2O Emissions from Inorganic N fertilizers: Countries' contributions to total EU- N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	583	422	391	1.2%	-192	-33%	-31	-7%	T1	D
Belgium	1 401	730	857	2.6%	-544	-39%	127	17%	T1	D
Bulgaria	1 649	1 429	1 419	4.3%	-230	-14%	-10	-1%	T1	D
Croatia	447	368	362	1.1%	-86	-19%	-7	-2%	T1	D
Cyprus	16	9	9	0.0%	-6	-41%	0	3%	T2	CS
Czechia	1 295	1 085	1 022	3.1%	-272	-21%	-62	-6%	T2	D
Denmark	1 667	995	822	2.5%	-846	-51%	-173	-17%	CS,T1	D
Estonia	300	175	160	0.5%	-140	-47%	-15	-9%	T1	D
Finland	1 522	720	939	2.8%	-583	-38%	219	30%	T1	D
France	11 446	7 859	7 521	22.8%	-3 925	-34%	-338	-4%	T2	D
Germany	5 555	2 843	2 625	8.0%	-2 930	-53%	-218	-8%	T2	CS
Greece	1 766	697	704	2.1%	-1 062	-60%	7	1%	T1	D
Hungary	1 491	1 359	1 106	3.4%	-385	-26%	-253	-19%	T1	D
Ireland	1 919	1 616	1 287	3.9%	-632	-33%	-329	-20%	T2	CS
Italy	3 083	1 168	1 978	6.0%	-1 105	-36%	810	69%	T1	CS,D
Latvia	547	343	334	1.0%	-213	-39%	-8	-2%	T1	D
Lithuania	883	544	530	1.6%	-352	-40%	-14	-3%	T1	D
Luxembourg	67	28	33	0.1%	-33	-50%	5	19%	T1	CS
Malta	2	9	9	0.0%	6	256%	0	2%	T1	D
Netherlands	1 762	913	935	2.8%	-827	-47%	22	2%	T2	CS
Poland	5 305	3 914	4 330	13.1%	-975	-18%	416	11%	T1	D
Portugal	648	273	361	1.1%	-287	-44%	88	32%	T1	CS,D
Romania	2 732	1 911	1 931	5.9%	-801	-29%	19	1%	T1	D
Slovakia	463	240	224	0.7%	-239	-52%	-16	-7%	T1	D
Slovenia	113	116	104	0.3%	-9	-8%	-12	-10%	T1	D
Spain	2 974	2 109	2 191	6.6%	-783	-26%	82	4%	CS,T1	D
Sweden	935	770	766	2.3%	-169	-18%	-3	0%	T2	CS
EU-27	**50 571**	**32 645**	**32 950**	**100%**	**-17 621**	**-35%**	**305**	**1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.44 3.D.1.a - Direct N_2O Emissions from Inorganic N fertilizers: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.1.a- Direct N_2O emissions from inorganic N fertilizers - Application of inorganic fertilizers

Application of inorganic fertilizers decreased strongly in the EU in the period 1990 to 2023.

In the new reporting format, the unit for N input on soils has been updated from kilograms of N to tons of N. However, some Member States reported data in the previous unit, which disrupted the compilation and analysis of data at the EU level. Thus, activity data is not reported here.

This issue was pointed out during the previous UNFCCC review. Efforts will be made to ensure that Member States report data in the appropriate unit, to ensure consistent compilation and analysis at EU level.

3.D.1.b - Direct N_2O emissions from organic N fertilizers - Emissions

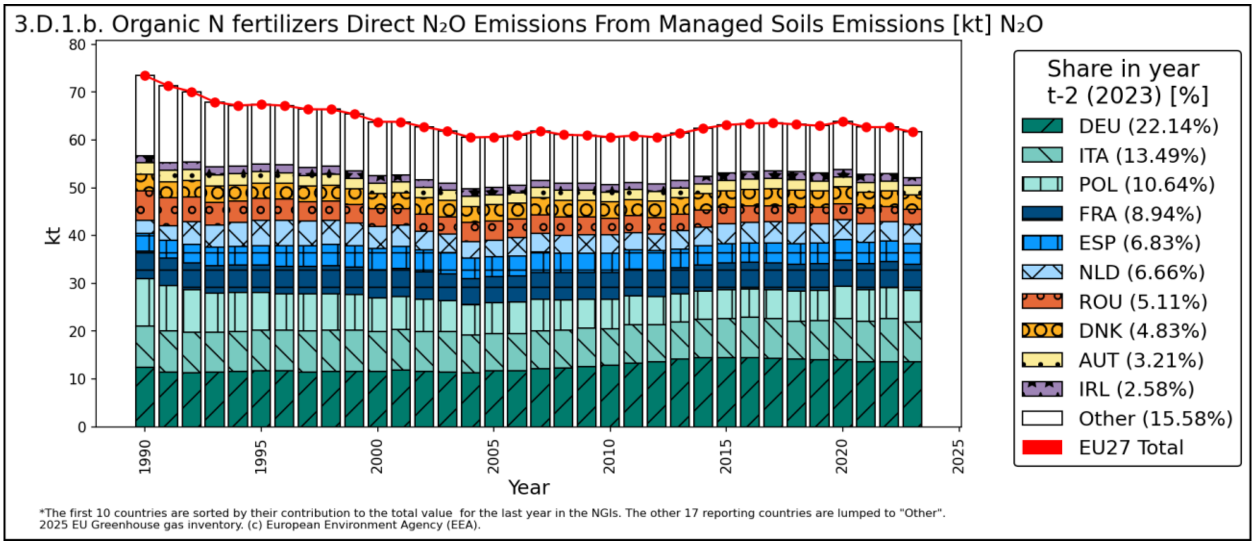
Emissions in source category *3.D.1.b - Direct N_2O Emissions from organic N fertilizers* decreased considerably in the EU by 16 % or 3.1 Mt CO_2-eq in the period 1990 to 2023. Figure 5.45 shows the trend of emissions indicating the countries contributing most to EU total. N_2O emissions by country and for the total EU from *3.D.1.b Direct N_2O Emissions From organic N fertilizers* are shown in Table 5.17 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.7 %.

Table 5.17 3.D.1.b - Direct N_2O Emissions From organic N fertilizers: Countries' contributions to total EU- N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	641	535	524	3.2%	-117	-18%	-12	-2%	CS,T1	D
Belgium	482	295	283	1.7%	-199	-41%	-11	-4%	T1	D
Bulgaria	569	162	160	1.0%	-409	-72%	-3	-2%	NA,T1	D,NA
Croatia	210	90	86	0.5%	-124	-59%	-4	-5%	NA,T1	D,NA
Cyprus	17	21	21	0.1%	4	20%	0	-1%	T2	CS
Czechia	314	173	179	1.1%	-135	-43%	6	4%	T2	D
Denmark	888	848	789	4.8%	-100	-11%	-59	-7%	CS,T1	D
Estonia	127	83	86	0.5%	-41	-32%	3	4%	T1	D
Finland	176	146	142	0.9%	-33	-19%	-4	-3%	T1	D
France	1 518	1 468	1 460	8.9%	-57	-4%	-8	-1%	T2	D
Germany	3 297	3 618	3 617	22.1%	321	10%	-1	0%	T2	CS
Greece	292	221	226	1.4%	-66	-23%	5	2%	CS,NA,T1	CS,D,NA
Hungary	788	415	399	2.4%	-389	-49%	-16	-4%	T1	D
Ireland	417	431	421	2.6%	4	1%	-9	-2%	NA,T1	D,NA
Italy	2 269	2 375	2 203	13.5%	-66	-3%	-172	-7%	T1	CS,D
Latvia	213	70	66	0.4%	-147	-69%	-4	-6%	T1	D
Lithuania	324	132	130	0.8%	-194	-60%	-2	-1%	T1	D
Luxembourg	33	33	33	0.2%	1	2%	0	0%	T1,T2	CS
Malta	11	8	7	0.0%	-4	-33%	-1	-15%	NA,T1	D,NA
Netherlands	691	1 061	1 088	6.7%	397	57%	27	2%	T1,T1b	CS,D
Poland	2 635	1 709	1 739	10.6%	-896	-34%	30	2%	NA,T1,T2	CS,D,NA
Portugal	256	208	206	1.3%	-50	-19%	-2	-1%	T1	CS,D
Romania	1 666	851	834	5.1%	-832	-50%	-17	-2%	T1	D
Slovakia	152	73	74	0.5%	-77	-51%	1	2%	NA,T1	CS,D,NA
Slovenia	123	94	94	0.6%	-29	-24%	0	0%	NA,T1	D,NA
Spain	1 018	1 135	1 116	6.8%	97	10%	-20	-2%	CS,T1	D
Sweden	335	356	353	2.2%	19	6%	-3	-1%	T1,T2	CS,D
EU-27	**19 460**	**16 612**	**16 335**	**100%**	**-3 124**	**-16%**	**-277**	**-2%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.45 3.D.1.b- Direct N_2O Emissions From Organic N fertilizers: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.1.b - Direct N_2O emissions from organic N fertilizers - amount of N applied

N from applied organic N fertilizers decreased in the EU in the period 1990 to 2023.

In the new reporting format, the unit for N input on soils has been updated from kilograms of N to tons of N. However, some Member States reported data in the previous unit, which disrupted the compilation and analysis of data at the EU level. Thus, activity data is not reported here.

This issue was pointed out during the previous UNFCCC review. Efforts will be made to ensure that Member States report data in the appropriate unit, to ensure consistent compilation and analysis at EU level.

3.D.1.c - Urine and Dung Deposited by Grazing Animals - Emissions

In 2023 N_2O emissions in source category *3.D.1.c - Urine and Dung Deposited by Grazing Animals* in the EU were 8886 kt CO_2 equivalent. It represents 2.4 % of total agricultural emissions and 7.0 % of total agricultural N_2O emissions.

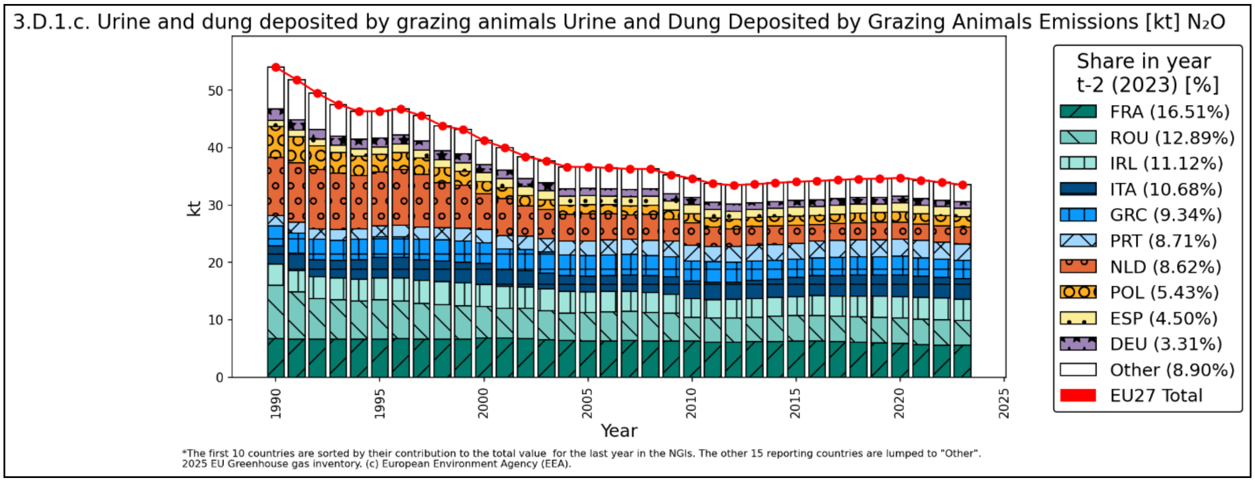
Total N_2O emissions by country and for the total EU from 3.D.1.c *Grazing Animals* are shown in Table 5.18 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 38 % or 5.4 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 1.3 %. Figure 5.46 shows the trend of emissions indicating the countries contributing most to EU total.

Table 5.18 3.D.1.c - Urine and Dung Deposited by Grazing Animals: Countries' contributions to total EU-GHG and N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	29	22	23	0.3%	-7	-23%	1	5%	T2	D
Belgium	212	133	129	1.5%	-83	-39%	-4	-3%	T1	D
Bulgaria	548	107	103	1.2%	-444	-81%	-4	-4%	T1	D
Croatia	120	49	44	0.5%	-76	-63%	-5	-10%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	33	31	31	0.3%	-3	-8%	0	-1%	T1	D
Denmark	60	26	25	0.3%	-34	-58%	-1	-4%	T2	D
Estonia	67	18	17	0.2%	-50	-74%	-1	-7%	T1	D
Finland	41	20	20	0.2%	-21	-52%	-1	-3%	T1	D
France	1 780	1 482	1 467	16.5%	-313	-18%	-15	-1%	T1,T2	D
Germany	522	291	294	3.3%	-228	-44%	3	1%	T1	D
Greece	943	835	830	9.3%	-114	-12%	-5	-1%	T1	D
Hungary	172	116	97	1.1%	-75	-44%	-20	-17%	T1	D
Ireland	977	1 013	988	11.1%	11	1%	-25	-2%	T2	CS
Italy	818	958	949	10.7%	131	16%	-8	-1%	T1	CS,D
Latvia	133	57	55	0.6%	-79	-59%	-2	-4%	T1	D
Lithuania	377	116	113	1.3%	-264	-70%	-3	-3%	T1	D
Luxembourg	19	16	16	0.2%	-3	-18%	0	-1%	T2	CS
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	2 693	744	766	8.6%	-1 927	-72%	22	3%	T1	D
Poland	1 413	485	482	5.4%	-931	-66%	-3	-1%	T1	CS,D
Portugal	479	797	774	8.7%	295	62%	-23	-3%	T1	D
Romania	2 477	1 153	1 145	12.9%	-1 332	-54%	-9	-1%	T1	D
Slovakia	24	18	18	0.2%	-6	-26%	0	-1%	T1	CS
Slovenia	17	34	34	0.4%	17	99%	0	-1%	T1	D
Spain	293	411	400	4.5%	107	37%	-11	-3%	CS,T1	D
Sweden	67	68	68	0.8%	0	0%	0	0%	T1	D
EU-27	**14 313**	**9 001**	**8 886**	**100%**	**-5 427**	**-38%**	**-115**	**-1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.46 3.D.1.c - Urine and Dung Deposited by Grazing Animals: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.1.d – Direct N_2O emissions from crop residues – Emissions

In 2023 N_2O emissions in source category *3.D.1.d – Direct N_2O emissions from crop residues* in the EU were 17366 kt CO_2 equivalent. It represents 4.8 % of total agricultural emissions and 13.7 % of total agricultural N_2O emissions.

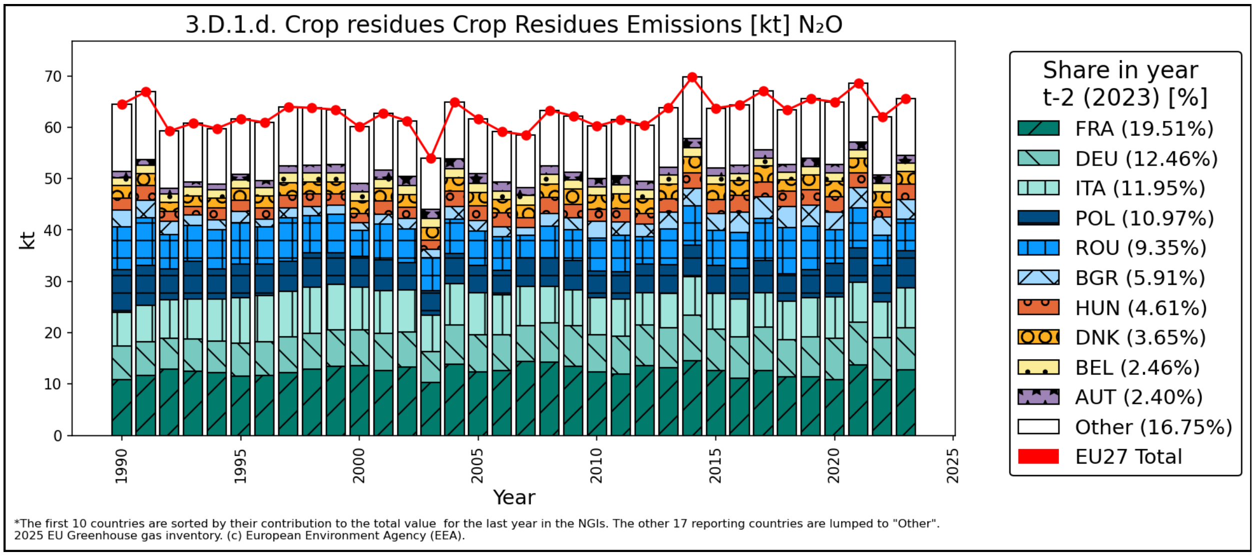
Total N_2O emissions by country and for the total EU from 3.D.1.d *Direct N_2O emissions from crop residues* are shown in Table 5.19 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category increased by 1.7 % or 0.3 Mt CO_2-eq. From 2022 to 2023 emissions in the current category increased by 5.8 %. Figure 5.47 shows the trend of emissions indicating the countries contributing most to EU total.

Table 5.19 3.D.1.d – Direct N_2O emissions from crop residues: Countries' contributions to total EU- N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	313	411	417	2.4%	105	33%	6	2%	T1	D
Belgium	396	431	428	2.5%	32	8%	-3	-1%	T1	D
Bulgaria	843	963	1 027	5.9%	184	22%	64	7%	T1	D
Croatia	166	150	162	0.9%	-5	-3%	11	8%	T1	D
Cyprus	8	4	4	0.0%	-4	-50%	0	-6%	T1	D
Czechia	542	377	385	2.2%	-157	-29%	7	2%	T2	D
Denmark	650	792	634	3.6%	-16	-3%	-159	-20%	CS,T1	D
Estonia	168	140	130	0.7%	-39	-23%	-11	-8%	T1	D
Finland	209	223	234	1.3%	24	12%	11	5%	T1	D
France	2 864	2 893	3 388	19.5%	524	18%	494	17%	T2	D
Germany	1 740	2 145	2 163	12.5%	423	24%	18	1%	T2	CS
Greece	297	203	204	1.2%	-93	-31%	1	1%	T1	D
Hungary	634	517	800	4.6%	166	26%	283	55%	T1	D
Ireland	133	106	92	0.5%	-41	-31%	-14	-13%	T1	D
Italy	1 731	1 841	2 074	11.9%	344	20%	233	13%	T1	CS,D
Latvia	136	142	118	0.7%	-18	-13%	-24	-17%	T1	D
Lithuania	306	345	315	1.8%	9	3%	-29	-9%	T2	D
Luxembourg	5	6	6	0.0%	1	12%	0	1%	T1	CS
Malta	4	3	3	0.0%	0	-13%	0	-3%	T1	D
Netherlands	420	299	297	1.7%	-123	-29%	-2	-1%	T1b	CS
Poland	2 218	1 891	1 904	11.0%	-314	-14%	14	1%	T1	CS,D
Portugal	218	147	140	0.8%	-78	-36%	-7	-5%	T1	D
Romania	2 222	1 538	1 623	9.3%	-599	-27%	85	5%	T1	D
Slovakia	163	116	144	0.8%	-19	-12%	29	25%	T2	CS
Slovenia	32	27	31	0.2%	-1	-4%	4	14%	T1	D
Spain	263	349	349	2.0%	87	33%	0	0%	CS,T1	D
Sweden	402	360	295	1.7%	-108	-27%	-65	-18%	T2	CS
EU-27	**17 082**	**16 421**	**17 366**	**100%**	**283**	**2%**	**945**	**6%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 5.47 3.D.1.d – Direct N_2O emissions from crop residues: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



5.3.4.2 Implied EFs and Methodological Issues

In this section we discuss the implied emission factor for the main N sources contributing to direct N_2O emissions from managed soils.

The figures showing the trend of the implied emission factor indicating also the range of values used by the countries have not been integrated this year as some Member States had issues with the reporting units that have been updated.

As mentioned earlier, this issue was pointed out during the previous UNFCCC review. Efforts will be made to ensure that Member States report data in the appropriate unit, to ensure consistent compilation and analysis at EU level.

3.D.1.a - Direct N_2O Emissions From Inorganic N fertilizers - Implied emission factor

No further analysis because of issues with reporting units.

3.D.1.b - Direct N_2O Emissions From Organic N fertilizers - Implied emission factor

No further analysis because of issues with reporting units.

3.D.1.c - Urine and Dung Deposited by Grazing Animals - Implied emission factor

No further analysis because of issues with reporting units.

3.D.1.d – Crop residues - Implied emission factor

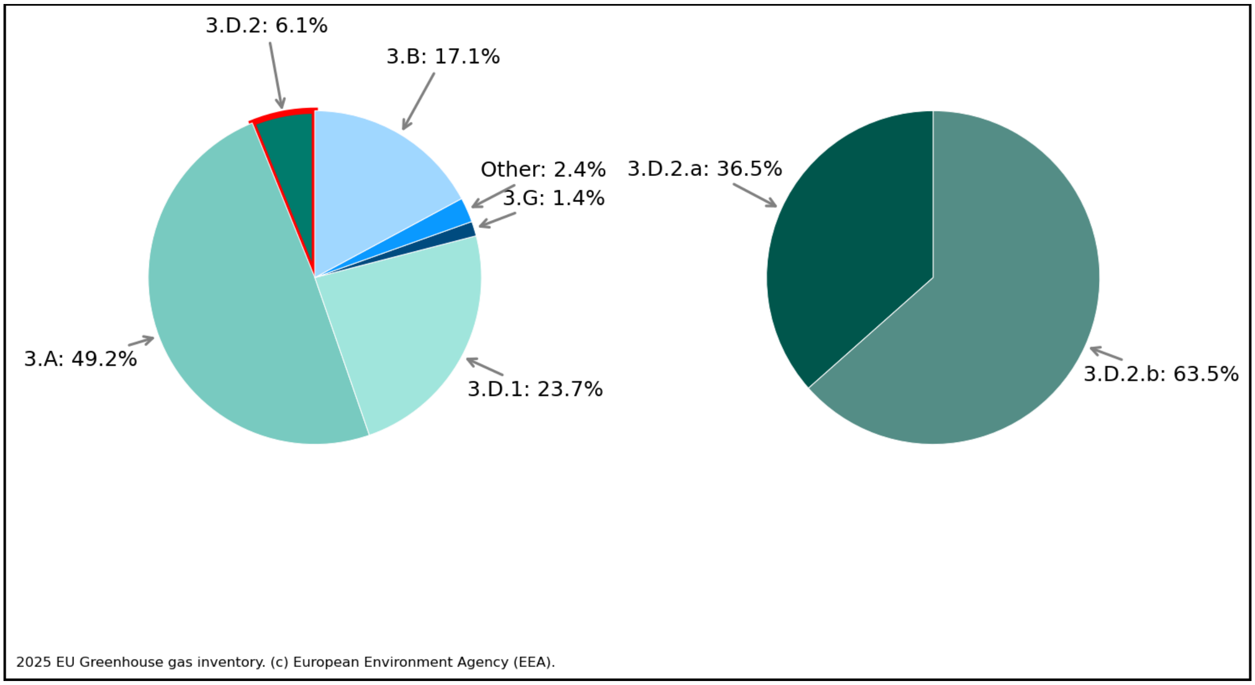
No further analysis because of issues with reporting units.

5.3.5 Indirect Emissions from Managed Soils - N_2O (CRT Source Category 3D2)

In 2023 N_2O emissions in source category *3.D.2 - Indirect Emissions from Managed Soils* in the EU were 22366 kt CO_2 equivalent. This corresponds to 0.8 % of total EU GHG emissions and 12.7 % of total EU N_2O emissions. They make 6.1 % of total agricultural emissions and 17.6 % of total agricultural N_2O emissions. Those emissions include emissions from atmospheric deposition and leaching and run-off.

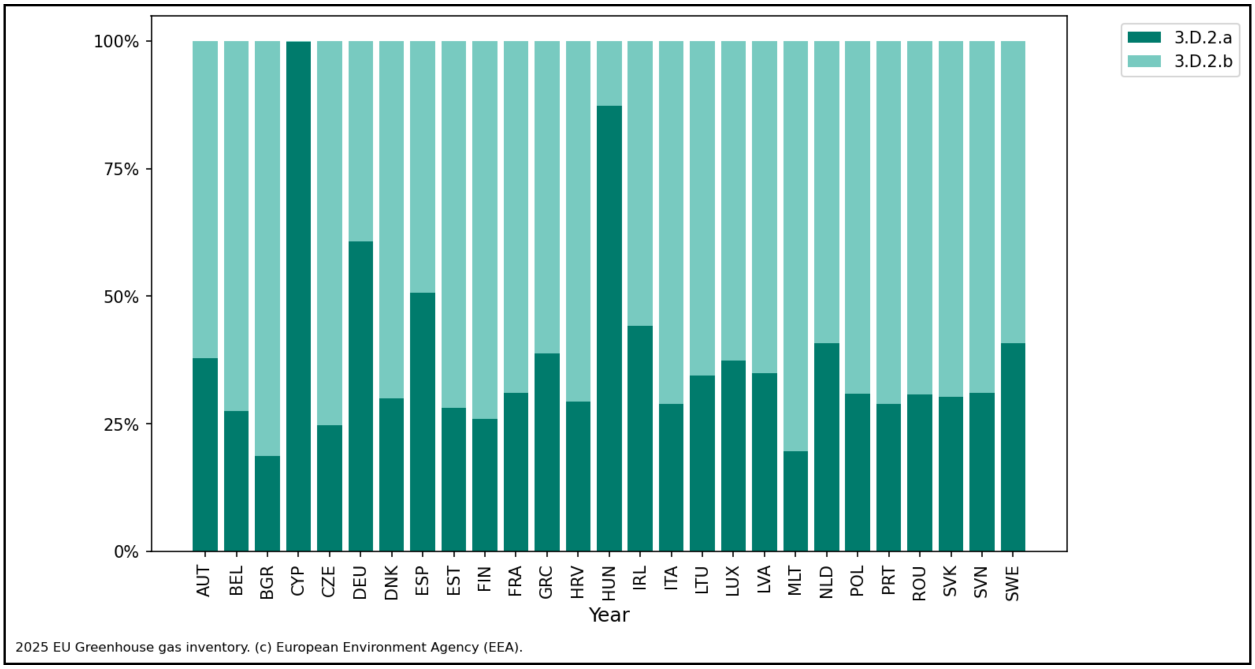
The main sub-categories are 3.D.2.b (Nitrogen Leaching and Run-off), and 3.D.2.a (Atmospheric Deposition) as shown in Figure 5.48. Regarding the origin of emissions in the different countries, Figure 5.49 shows the distribution of indirect N_2O emissions from managed soils by emission source in all countries. Each bar represents the total emissions of a country in the current emission category, where different shades of purple correspond to the emitting sub-categories.

Figure 5.48 Share of source category 3.D.2 on total EU agricultural emissions (left panel) and decomposition into its sub-categories (right panel). The percentages refer to the emissions in the year 2023.



In the left panel, some minor differences in the numbers might be present due to automatic rounding of numbers.

Figure 5.49 Decomposition of emissions in source category 3.D.2 - Indirect Emissions from Managed Soils into its sub-categories by country in the year 2023. 3.D.2.a Atmospheric Deposition and 3.D.2.b Nitrogen Leaching and Run-off.



Total N_2O emissions by country and for the total EU from 3.D.2 *Indirect Emissions from Managed Soils* are shown in Table 5.20 for the first and the last year of the inventory (1990 and 2023). Values are given in kt CO_2-eq. Between 1990 and 2023, N_2O emission in this source category decreased by 32 % or 10.6 Mt CO_2-eq. From 2022 to 2023 emissions in the current category increased by 1.4 %.

Table 5.20 3.D.2 - Indirect Emissions from Managed Soils: Countries' contributions to total EU-GHG and N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	467	386	376	1.7%	-92	-20%	-11	-3%	CS,T1	D
Belgium	1 225	706	721	3.2%	-505	-41%	15	2%	T1	D
Bulgaria	1 104	738	747	3.3%	-357	-32%	9	1%	T1	D
Croatia	310	213	209	0.9%	-100	-32%	-4	-2%	T1	D
Cyprus	17	17	17	0.1%	0	1%	0	0%	T1	D
Czechia	1 150	829	735	3.3%	-415	-36%	-94	-11%	T1,T2	D
Denmark	1 419	668	711	3.2%	-708	-50%	43	6%	T2	D
Estonia	205	132	125	0.6%	-79	-39%	-7	-5%	T1	D
Finland	381	253	274	1.2%	-107	-28%	21	8%	T2	D
France	5 309	4 204	4 288	19.2%	-1 021	-19%	85	2%	T1,T2	D
Germany	4 932	3 110	2 886	12.9%	-2 046	-41%	-224	-7%	T2,T3	D
Greece	1 148	704	706	3.2%	-442	-39%	2	0%	T1	D
Hungary	301	197	166	0.7%	-135	-45%	-32	-16%	T1	D
Ireland	758	705	650	2.9%	-108	-14%	-55	-8%	T1	CS,D
Italy	2 584	1 815	2 031	9.1%	-553	-21%	216	12%	T1	CS,D
Latvia	277	155	141	0.6%	-137	-49%	-14	-9%	T1	D
Lithuania	389	212	205	0.9%	-184	-47%	-7	-3%	T1	D
Luxembourg	58	41	42	0.2%	-15	-27%	2	4%	T1,T2	D
Malta	6	7	6	0.0%	1	10%	0	-7%	T1	D
Netherlands	1 436	509	503	2.2%	-934	-65%	-6	-1%	T1	D
Poland	3 671	2 539	2 689	12.0%	-982	-27%	150	6%	T1	D
Portugal	439	346	364	1.6%	-75	-17%	18	5%	T1,T2	D
Romania	2 934	1 735	1 749	7.8%	-1 186	-40%	14	1%	T1	D
Slovakia	611	110	303	1.4%	-309	-50%	193	175%	T1,T2	CS,D
Slovenia	114	100	97	0.4%	-18	-15%	-3	-3%	T1	D
Spain	1 453	1 386	1 385	6.2%	-68	-5%	-2	0%	CS,T2	D
Sweden	307	239	241	1.1%	-67	-22%	1	1%	CS	D
EU-27	**33 008**	**22 055**	**22 366**	**100%**	**-10 642**	**-32%**	**310**	**1%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

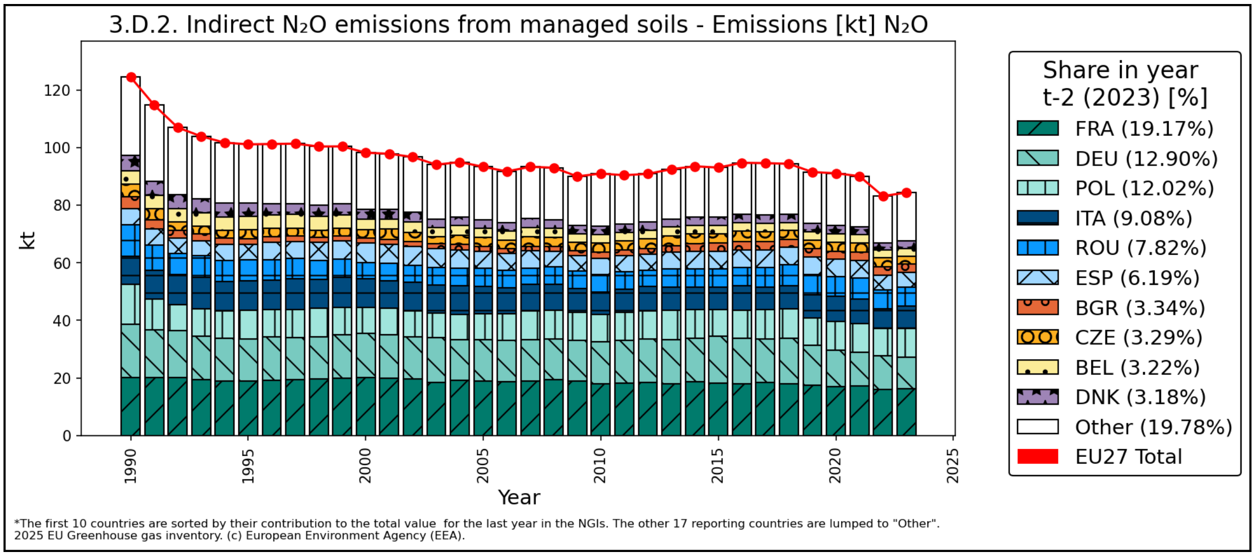
Abbreviations are explained in the Chapter 'Units and abbreviations'.

5.3.5.1 Trends in Emissions and Activity Data

3.D.2 - Indirect Emissions from Managed Soils - Emissions

Emissions in source category *3.D.2 - Indirect Emissions from Managed Soils* decreased strongly in the EU in the period 1990 to 2023. Figure 5.50 shows the trend of emissions indicating the countries contributing most to EU total.

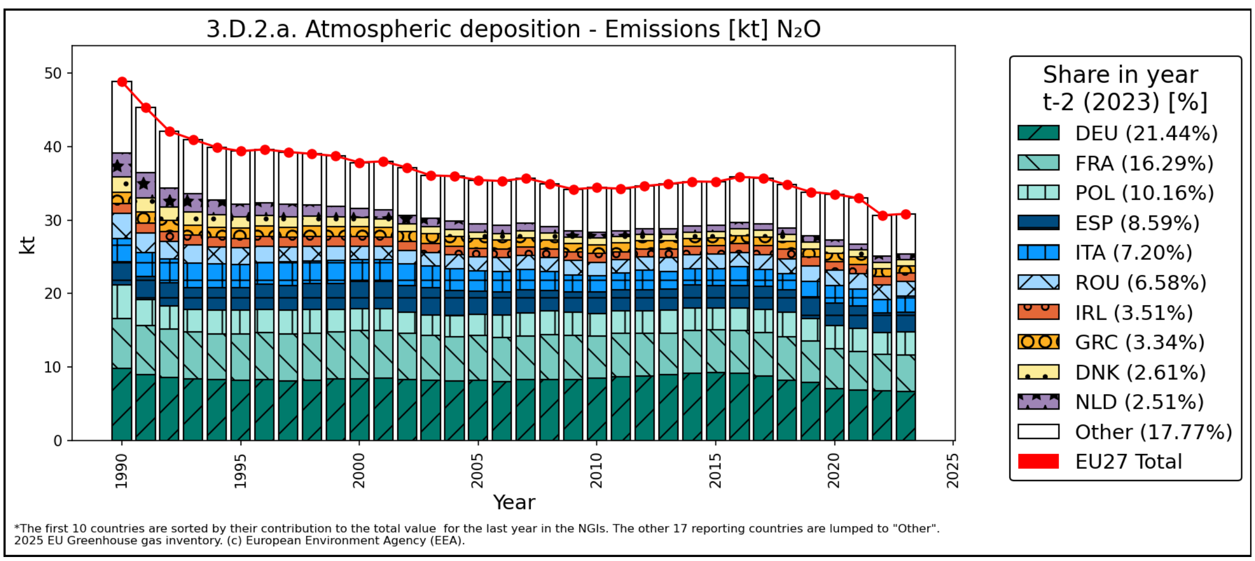
Figure 5.50 3.D.2 Indirect Emissions from Managed Soils: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.2.a - Indirect N_2O Emissions from Atmospheric Deposition - Emissions

Emissions in source category *3.D.2.a - Indirect N_2O Emissions from Atmospheric Deposition* decreased strongly in the EU by 37 % or 4.8 Mt CO_2-eq in the period 1990 to 2023. Figure 5.51 shows the trend of emissions indicating the countries contributing most to EU total.

Figure 5.51 3.D.2.a - Indirect N_2O Emissions from Atmospheric Deposition: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.2.a - Indirect N_2O Emissions from Atmospheric Deposition - Volatilized N from agricultural N inputs

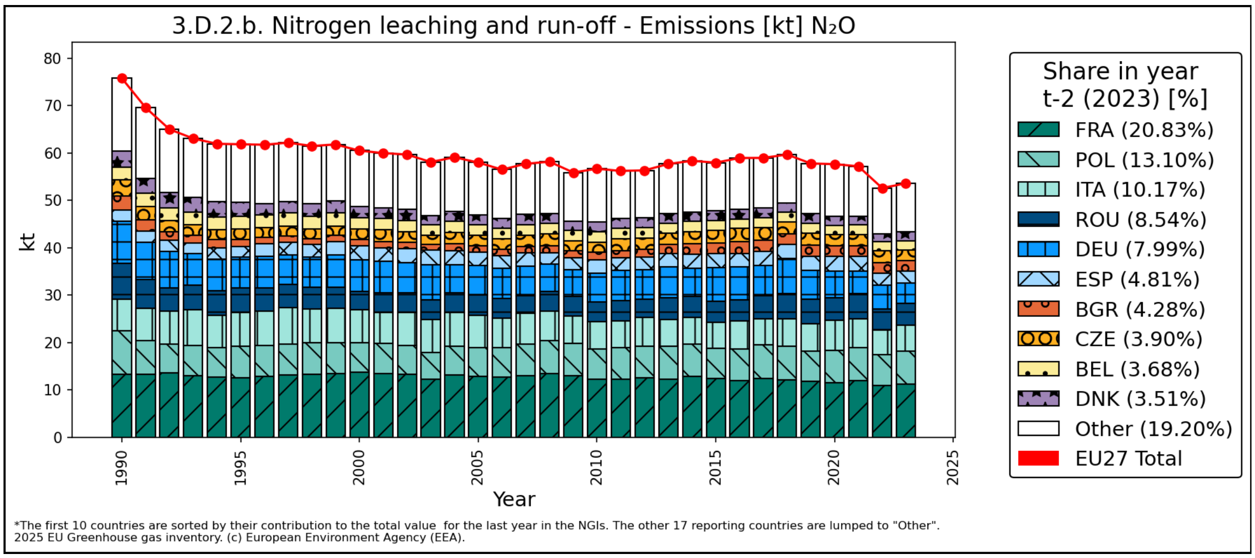
Volatilized N from agricultural N inputs decreased in the EU in the period 1990 to 2023.

Some Member States had issues reporting all activity data needed in the new reporting format, with correct reporting units. This disrupted the compilation and analysis of data at the EU level. Thus, activity data is not reported here. This issue was pointed out during the previous UNFCCC review. Efforts will be made to ensure that Member States report complete data in the appropriate unit, to ensure consistent compilation and analysis at EU level.

3.D.2.b - Indirect N_2O Emissions from Nitrogen leaching and run-off - Emissions

Emissions in source category *3.D.2.b - Indirect N_2O Emissions from Nitrogen leaching and run-off* decreased considerably in the EU by 29 % or 5.9 Mt CO_2-eq in the period 1990 to 2023. Figure 5.52 shows the trend of emissions indicating the countries contributing most to EU total.

Figure 5.52 3.D.2.b - Indirect N_2O Emissions from Nitrogen leaching and run-off: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



3.D.2.b- Indirect N_2O Emissions from Nitrogen leaching and run-off - N from fertilizers and other agricultural inputs that is lost through leaching and run-off

N from fertilizers and other agricultural inputs that is lost through leaching and run-off decreased considerably in the EU in the period 1990 to 2023.

Some Member States had issues reporting all activity data needed in the new reporting format, with correct reporting units. This disrupted the compilation and analysis of data at the EU level. Thus, activity data is not reported here. This issue was pointed out during the previous UNFCCC review. Efforts will be made to ensure that Member States report complete data in the appropriate unit, to ensure consistent compilation and analysis at EU level.

5.3.5.2 Implied EFs and Methodological Issues

In this section we discuss the implied emission factor for the main N sources contributing to indirect N_2O emissions from managed soils

The figure showing the trend of the implied emission factor indicating also the range of values used by the countries has not been integrated this year as some Member States had issues with the new reporting format.

3.D.2.a - Indirect N_2O Emissions from Atmospheric Deposition

No further analysis because of issues with reporting units.

3.D.2.b - Indirect N_2O Emissions from Nitrogen leaching and run-off

No further analysis because of issues with reporting units.

5.3.6 Limestone $CaCO_3$ - CO_2 (CRT Source Category 3.G.1)

In 2023 CO_2 emissions in source category *3.G.1 - Limestone* in the EU were 4639 kt CO_2 equivalent. This corresponds to 0.2 % of total EU GHG emissions and 0.2 % of total EU CO_2 emissions. They make 1.3 % of total agricultural emissions and 50 % of total agricultural CO_2 emissions.

CO_2 emissions from *3.G.1 Limestone* are shown in Table 5.21 by country, and the total EU for the first and the last year of the inventory (1990 and 2023) is provided. Values are given in kt CO_2-eq. Between 1990 and 2023, CO_2 emission in this source category decreased by 31 % or 2.1 Mt CO_2-eq. From 2022 to 2023 emissions in the current category decreased by 7 %.

Table 5.21 3.G.1 – CO_2 Emissions from Limestone : Countries' contributions to total EU-GHG and CO_2 emissions

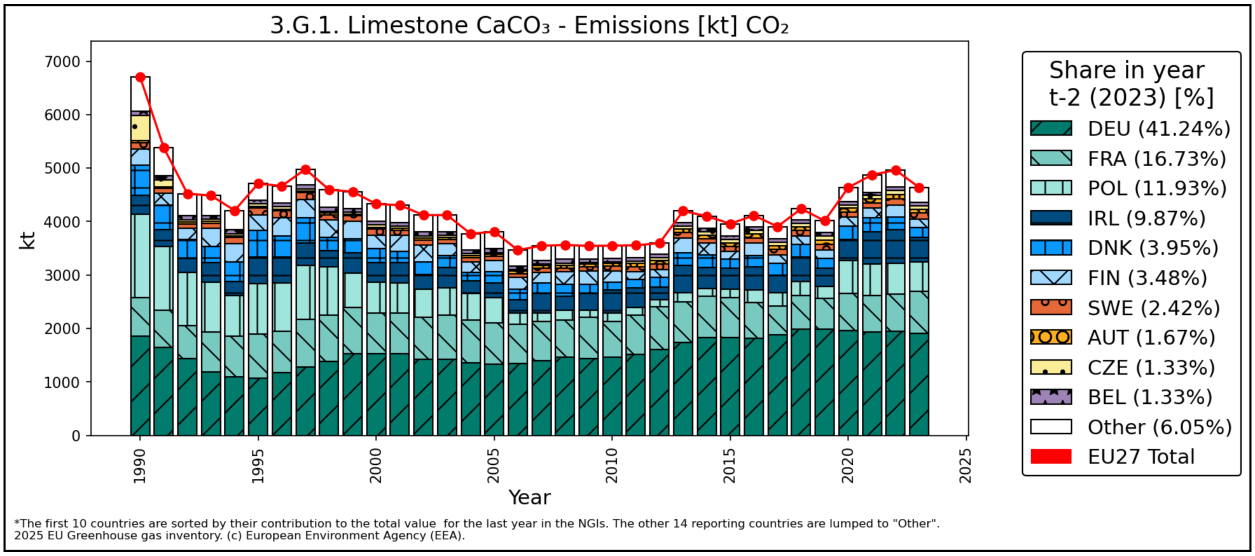
Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2	%	kt CO2	%		
Austria	37	81	78	1.7%	41	111%	-3	-4%	T1	D
Belgium	78	62	62	1.3%	-16	-21%	0	-1%	T1	D
Bulgaria	29	25	25	0.5%	-4	-14%	0	0%	T1	D
Croatia	NO	3	3	0.1%	3	∞	0	9%	T1	D
Cyprus	NO	NO	NO	-	-	-	-	-	NA	NA
Czechia	471	85	62	1.3%	-409	-87%	-23	-27%	T1	D
Denmark	565	246	183	3.9%	-382	-68%	-62	-25%	T1	D
Estonia	12	33	25	0.5%	13	103%	-9	-26%	T1	D
Finland	302	217	161	3.5%	-140	-47%	-56	-26%	T1	D
France	727	705	776	16.7%	49	7%	71	10%	T1	D
Germany	1 850	1 943	1 913	41.2%	63	3%	-30	-2%	T1	D
Greece	NO	NO	NO	-	-	-	-	-	NA	NA
Hungary	140	3	4	0.1%	-136	-97%	0	8%	T1	D
Ireland	355	624	458	9.9%	103	29%	-166	-27%	T1	D
Italy	1	2	3	0.1%	2	284%	1	23%	T1	D
Latvia	171	59	44	0.9%	-127	-74%	-15	-25%	T1	D
Lithuania	21	47	41	0.9%	21	100%	-6	-12%	T1	D
Luxembourg	NO	2	1	0.0%	1	∞	0	-28%	T1	D
Malta	NO	NO	NO	-	-	-	-	-	NA	NA
Netherlands	26	23	17	0.4%	-9	-34%	-6	-28%	T1	D
Poland	1 562	573	553	11.9%	-1 009	-65%	-20	-3%	T1	D
Portugal	6	7	8	0.2%	2	35%	1	14%	T1	D
Romania	67	65	45	1.0%	-21	-32%	-19	-30%	T1	D
Slovakia	44	1	9	0.2%	-35	-79%	8	942%	T1	D
Slovenia	44	21	29	0.6%	-15	-35%	8	37%	T1	D
Spain	82	26	27	0.6%	-55	-67%	1	3%	T1	D
Sweden	113	112	112	2.4%	0	0%	0	0%	T1	D
EU-27	**6 702**	**4 964**	**4 639**	**100%**	**-2 062**	**-31%**	**-325**	**-7%**	**-**	**-**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

Abbreviations are explained in the Chapter 'Units and abbreviations'.

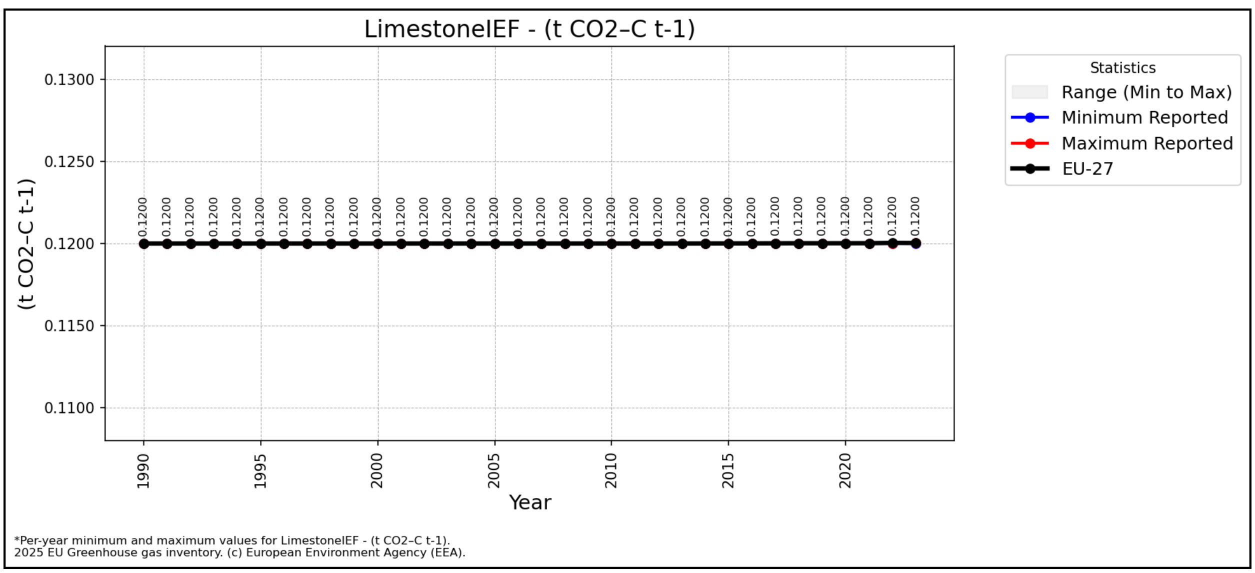
Figure 5.53 shows the trend of emissions indicating the countries contributing most to EU total. The figure represents the trend in CO_2 emissions from limestone for the different countries along the inventory period.

Figure 5.53 3.G.1: Trend in emissions in the EU and the countries contributing most to EU values including their share to EU emissions in 2023



The implied emission factor for CO_2 emissions is constant through time as the Tier 1 method is applied by all Member States, using the default emission factor provided by the IPCC.

Figure 5.54 3.G.1: Trend in implied emission factor and range of values reported by countries



5.3.7 Agriculture - non-key categories

Table 5.22 Non-key categories in agriculture

EU	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 3. Agriculture in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
3.C.1. Irrigated: no classification (CH4)	3 099.1	2 318.7	2 298.9	0.6%	-800	-26%	-19.9	-1%
3.C.2. Rain-fed: no classification (CH4)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.C.3. Deep water: no classification (CH4)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.C.4 Other: no classification (CH4)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.E.1. Forest land (specify ecological zone): no classification (CH4)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.E.1. Forest land (specify ecological zone): no classification (N2O)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.E.2. Grassland (specify ecological zone): no classification (CH4)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.E.2. Grassland (specify ecological zone): no classification (N2O)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.F.1. Cereals: Cereals (CH4)	1 350.8	616.1	548.1	0.1%	-803	-59%	-68.0	-11%
3.F.1. Cereals: Cereals (N2O)	355.3	172.2	152.3	0.0%	-203.0	-57%	-19.9	-12%
3.F.2. Pulses: Pulses (CH4)	1.4	0.2	0.2	0.0%	-1	-84%	0.0	-10%
3.F.2. Pulses: Pulses (N2O)	0.4	0.1	0.1	0.0%	0	-77%	0.0	-15%
3.F.3. Tubers and roots: Tubers and Roots (CH4)	219.3	2.4	2.3	0.0%	-217	-99%	-0.1	-4%
3.F.3. Tubers and roots: Tubers and Roots (N2O)	56.9	1.1	1.0	0.0%	-56	-98%	-0.1	-6%
3.F.4. Sugar cane: Sugar Cane (CH4)	8.5	1.6	1.5	0.0%	-7	-82%	-0.1	-4%
3.F.4. Sugar cane: Sugar Cane (N2O)	2.1	0.4	0.4	0.0%	-2	-82%	0.0	-4%
3.F.5 Other: Other Agricultural residues (CH4)	109.1	43.1	42.6	0.0%	-66	-61%	-0.5	-1%
3.F.5 Other: Other Agricultural residues (N2O)	28.7	15.5	14.9	0.0%	-14	-48%	-0.6	-4%
3.G.2. Dolomite CaMg(CO3)2: no classification (CO2)	2 734.0	568.4	559.2	0.1%	-2 175	-80%	-9.2	-2%
3.H. Urea application: no classification (CO	3 648.2	3 159.3	3 488.9	0.9%	-159	-4%	329.6	10%
3.I. Other carbon-containing fertilizers: no classification (CO2)	1 109.0	591.0	565.3	0.1%	-544	-49%	-25.7	-4%
3.J Other: no classification (CH4)	0.3	1 514.5	1 514.5	0.4%	1 514.2	482978%	0.0	0%
3.J Other: no classification (CO2)	0.0	0.0	0.0	0.0%	0	0%	0.0	0%
3.J Other: no classification (N2O)	0.1	122.2	122.2	0.0%	122	114051%	0.0	0%

5.4 Uncertainties

Table 5.23 shows the total EU uncertainty estimates for the sector Agriculture and the uncertainty estimates for the relevant gases of each source category. The highest-level uncertainty was estimated for N_2O from 3D and the lowest for CH_4 from sector 3A. With regard to the uncertainty on trend N_2O from sector 3J shows the highest uncertainty estimates, CH_4 from sector 3A the lowest. For a description of the Tier 1 uncertainty analysis carried out for the EU see Chapter 1.6.

Table 5.23 Sector Agriculture: EU uncertainty estimates

Source category	Gas	Emissions Base Year	Emissions 2022	Emission trends Base Year-2021	Level uncertainty estimates based on MS uncertainty	Trend uncertainty estimates based on MS uncertainty
3.A Enteric Fermentation	CO2	0	0	0.0%	0.0%	0.0%
3.A Enteric Fermentation	CH4	237 259	180 808	-23.8%	13.7%	1.6%
3.A Enteric Fermentation	N2O	0	0	0.0%	0.0%	0.0%
3.B Manure Mangement	CO2	0	0	0.0%	0.0%	0.0%
3.B Manure Mangement	CH4	54 611	44 849	-17.9%	22.0%	1.7%
3.B Manure Mangement	N2O	25 645	17 362	-32.3%	69.4%	12.0%
3.C Rice Cultivation	CO2	0	0	0.0%	0.0%	0.0%
3.C Rice Cultivation	CH4	2 750	2 039	-25.9%	17.1%	21.6%
3.C Rice Cultivation	N2O	0	0	0.0%	0.0%	0.0%
3.D Agricultural Soils	CO2	0	0	0.0%	0.0%	0.0%
3.D Agricultural Soils	CH4	0	0	0.0%	0.0%	0.0%
3.D Agricultural Soils	N2O	146 478	108 227	-26.1%	68.6%	9.4%
3.E Prescribed burning of savannas	CO2	0	0	0.0%	0.0%	0.0%
3.E Prescribed burning of savannas	CH4	0	0	0.0%	0.0%	0.0%
3.E Prescribed burning of savannas	N2O	0	0	0.0%	0.0%	0.0%
3.F Field Burning of Agricultural Residues	CO2	0	0	0.0%	0.0%	0.0%
3.F Field Burning of Agricultural Residues	CH4	804	671	-16.5%	49.1%	5.2%
3.F Field Burning of Agricultural Residues	N2O	226	191	-15.5%	48.2%	5.5%
3.G Liming	CO2	9 352	5 662	-39.5%	23.5%	6.4%
3.G Liming	CH4	0	0	0.0%	0.0%	0.0%
3.G Liming	N2O	0	0	0.0%	0.0%	0.0%
3.H Urea application	CO2	3 210	2 849	-11.3%	22.5%	3.3%
3.H Urea application	CH4	0	0	0.0%	0.0%	0.0%
3.H Urea application	N2O	0	0	0.0%	0.0%	0.0%
3.I Other carbon-containing fertilizers	CO2	964	553	-42.7%	14.6%	4.8%
3.I Other carbon-containing fertilizers	CH4	0	0	0.0%	0.0%	0.0%
3.I Other carbon-containing fertilizers	N2O	0	0	0.0%	0.0%	0.0%
3.J Other	CO2	0	0	0.0%	0.0%	0.0%
3.J Other	CH4	0	1 457	464688.0%	22.4%	103904.2%
3.J Other	N2O	0	166	157588.7%	97.6%	153759.3%
3 (w here no subsector data w ere submitte	all	1 922	886	-53.9%	24.2%	20.4%
Total - 3	**all**	**483 222**	**365 719**	**-24.3%**	**21.9%**	**3.0%**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions of the EU-NID because uncertainty estimates are not available for all source categories in each of this EU countries

5.5 Sector-specific quality assurance and quality control and verification

5.5.1 Introduction

This section gives an overview of the QA/QC procedures applied specifically for the agriculture sector of the EU GHG inventory. It first gives an overview of the development of the agriculture QA/QC system with an outlook of further improvements to be discussed and/or implemented in coming years. A brief description of the QA/QC procedures used to process the data and interact with the countries is given. A brief summary of selected activities that have been carried out in the past to improve and/or verify national and EU wide

GHG emissions from agriculture in the frame of the EU GHG inventory system is found in the inventory report of 2020[21].

5.5.1.1 Main improvements in the 2025 submission

In the 2025 submission, the main improvement consisted in pursuing the implementation of the new reporting format (CRT tables). For example, recommendation 5.A.4 from the last UNFCCC review – which was linked to issues with the ETF reporting tool - has been implemented: all the graphs presented in the NID include all EU Member States. However, some issues remain, mainly regarding reporting units for activity data, but efforts will be made to improve future submissions on this.

Furthermore, a section dedicated to CO_2 emissions from limestone (key category) has been added this year.

5.5.2 QA/QC system in the agriculture sector

5.5.2.1 Quality checks

Several quality checks are performed. The checks include:

- **Recommendations**: Country were checked if they had implemented last years' recommendations from the ESD review and from the UNFCCC review.
- **Check on NEs**[23] and empty cells has been done by extracting all reported 'NE's from the data base.
- **Notation keys**: we identified emission categories where a country reported a notation key, while 22 or more countries reported emission estimates, in order to assess the potential over/underestimations (these also contained in NE checks and reporting of identical values as in previous submission).
- **Outliers in activity data and emissions**: Data were checked on outliers in AD and emissions. For each source category the share of AD and emissions by the countries to total EU values were determined. A share above 95 % was further assessed and in case this was not linked to a source category which is dominated by single countries (such as emissions from buffalo, which are dominated by Italy) the country was notified.
- **Check on erroneous units**: In several case, countries report background data using different units (e.g. fractions instead of percent values or vice versa; values per day instead of per year of vice versa; absolute values instead of values per head etc.). While these inconsistencies do not influence the reported emission estimates, a harmonization (at EU level) is important to ensure correct comparison of countries' values and a correct calculation of EU background data. An automated check[24] is carried out detecting *three* cases which can easily be recognised. Other 'mistakes' in units used were detected following the outlier analysis (see below). The countries were notified via the review tool and in many cases corrections have already been implemented.
- **Within-country outliers**: within-country outliers in IEFs and other parameters are detected on the basis of the distribution of the values provided[25]. We used the method based on the mean values and the standard deviation. Specifically, those values were identified as outliers which were more distant from than 1.5 time the standard deviation in the data from the mean (both in positive and negative direction). As an additional criterium, the relation to the median was used. In case the value was within 10 % of the median it was not considered as an outlier. This removed cases where a country uses a country-specific parameter while most countries use the default value.

- **Identification of potentially significant issues**: For each of the outliers identified it was determined whether or not this could be a potentially significant issue based on the criterium of a share of 0.5 % of national total GHG emissions. The 'size' of the possible over- or under-estimation was quantified comparing the reported value with an estimate using the median IEF or parameter as reported by all countries[26]. All outliers were 'manually' cross-checked and analysed. Countries were notified on the results of the analysis.
- **Time series outliers/inconsistencies**: Time series outliers were detected on the basis of the same method as also used for the within-country-outlier check. Basis for the underlying distribution of data in this case, however, was not the values reported from all countries during the whole time series, but only the data reported by the country assessed. Only growth rates larger than ±3 % could qualify as 'outliers'. However, this generated a large number of potential outliers which require further assessment. The following types of 'issues' were identified, which might be linked either to an inconsistent time series or be the consequence of 'real' trends:

Period outphased: Relative constant trend with few years above/below the trend that 'looks plausible'.

Trend break: Timeseries in steps, in a stair shape: a few similar values, then a jump, and the same again.

One break group trend: Regular timeseries with a different trend for a group of years, and a step when jumping from/coming back to the general trend.

Inflection point: Trend suddenly changes from a specific year from which the growth of the values changes sign.

Single outlier: One or few isolated year(s) where the value is out of the general trend

Smooth group trend change: A series of years where the trend changes compared to the rest of the time series, but without any jumps

Trend jump: There is a jump at some point in the time trend but it continues running parallel to the first section, after the jump.

Jump and shape: There is a jump at some point in the time trend and, after the jump, the trend changes shape

- **Sector-specific checks**: Several checks were performed tailored to the reporting in the sector agriculture[27,28]. First, the data are checked on consistency in reporting of activity data throughout the tables. Further, several other tests are performed:

Difference between the sum of nitrogen excreted and reported in the different manure management system (MMS) versus the total reported nitrogen excreted.

Difference between the total nitrogen excreted and the product of animal population and nitrogen excretion rate.

Difference of the sum of N handled in MMS over animal type vs. total N handled in each MMS.

Check of the reported IEF per MMS with the total N excreted and the reported emissions.

Check that the sum of manure allocated to climate regions adds up to 100 % over all MMS and climate regions.

Check that compares the Manure 'managed' in Pasture Range and Paddock in category 3.B N_2O with AD in 3.D.1.c (Urine and Dung Deposited by Grazing Animals). The sum of FPRP over all animal types should therefore equal the AD in category 3.D.1.c.

Comparison of the fraction of N lost in MMS (via volatilization of NH_3+NO_x) versus total managed manure. According to IPCC Table 50.22[29] most of the loss fractions are between 20% and 45% of N in managed manure and N loss ratios are identified that are higher than 45% or lower than 20%.

Comparison of the manure 'managed' and not lost as NH_3+NO_x+N_2 or leaching in MMS (3B2) with Animal manure applied to soil (3D12a). Manure available for application is obtained from N managed in MMS and not lost (FracLOSSMS) according to IPCC Table 10.23[30] plus any addition of bedding material. In the new reporting format, N_2 losses must be reported with NH_3 and NO_x losses. Thus, FAM is expected to be equal to N managed in MMS minus N lost as NH_3+NO_x+N2+leaching unless bedding material has been accounted for, or if manure is exported. In case of crop residues as bedding material care has to be taken to avoid double counting.

- **Recalculation**: Countries were asked for justifications of recalculations of more than 0.5% of national total emissions (excluding LULUCF) and above or below the mean recalculations across all MS ±1.5 standard deviations.

A slightly higher number of issues has been identified (149 for 2025) compared to last year (120 were identified for 2024):

- 16 completeness issues (related to 'NE'/'empty'/'notation keys')
- 0 country-outlier issues
- 61 agricheck issues
- 40 previous recommendations (ESD and UNFCCC review)
- 16 recalculation issues
- 16 consistency issues in Annexe IX

5.5.2.2 Calculation of EU background data

EU-wide background data were calculated as weighted averages of the parameters provided by the countries, using activity data (animal numbers in category 3A and 3B and N input in category 3D) as weighting factors[31].

5.5.2.3 Compilation of the chapter agriculture for the EU-GHG inventory report

The presented data was automatically generated using an automated process from the member state submitted data. This minimizes the risk of transcription or copying errors but does not eliminate completely the existence of errors.

5.6 Sector-specific recalculations

Recalculations are described in chapter 10.1, including the explanations for significant changes (>1000 kt CO_2eq) in categories.

5.7 Sector-specific improvements

In 2024 and 2025 the reporting has been amended to be in line with the new CRT reporting tables, as well as the NID outline. Descriptions of categories have been aligned accordingly. Information across sectors has been streamlined to provide a harmonised approach across the whole NID. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

Improvements planned for the next reporting are continuing the efforts to ensure consistency between.

6 LAND USE, LAND–USE CHANGE AND FORESTRY (CRT SECTOR 4)

6.1 Overview of the sector

Within the EU GHG inventory, the LULUCF sector shows higher removals by sinks than emissions by sources, as a result the sector represents a net carbon sink.

In terms of land use categories, a net carbon sink is reported under Forest land. In addition, Harvested Wood Products also result in a net carbon sink for the EU GHG inventory. Other land use categories are net sources: Cropland is the largest source of emissions, followed by the conversion of lands to Settlements. Grasslands, along with the other categories, represent a smaller source of emissions.

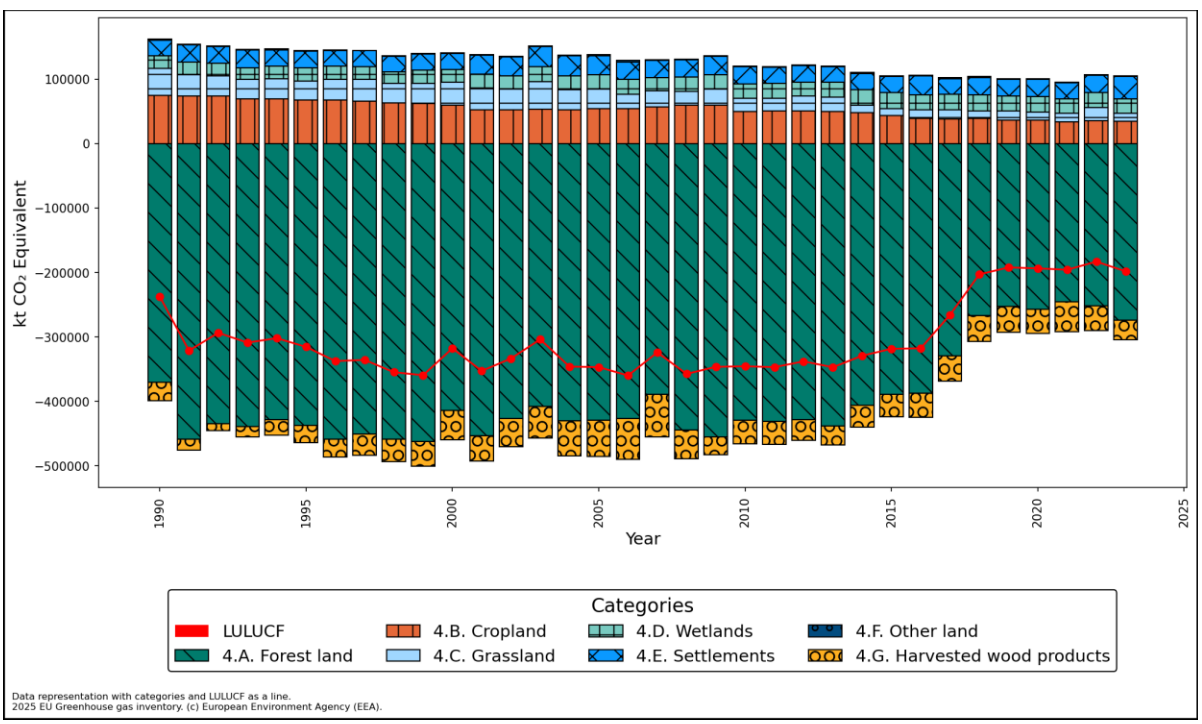
In 2023, the LULUCF sector of the EU results in a total net sink of -226 476 kt CO_2, which represents a decrease of 15% as compared to the net sink reported for the year 1990 (Table 6.1).

Within the LULUCF sector, the carbon pool Harvested Wood Products is in 2023 reported as a net carbon sink of -30 482 kt CO_2. On the other hand, emissions of CH_4 and N_2O in 2023 represent about 14% of annual net carbon sink.

In terms of CO_2 equivalent *LULUCF* results for the year 2023 in -198 421 kt CO_2 equivalent.

Moreover, France has reported GHG emissions in the CRT table 4, under the category “Other”. France reports CO_2 and CH_4 emissions from Reservoir of Petit-Saut in French Guiana, and biogenic NMVOC emissions from managed forest.

Figure 6.1 Sector 4 LULUCF: EU GHG net emissions (+) / removals (-) for 1990–2023, in CO_2 eq. (kt).



Source: EU MS submissions 2025, CRT table 4

Table 6.1: Sector 4. LULUCF: individual Member States contributions to net CO_2 removals

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	-13 974	-415	7 323	-3.2%	21 297	152%	7 739	1863%
Belgium	-2 842	-573	-363	0.2%	2 478	87%	210	37%
Bulgaria	-17 317	-9 284	-8 740	3.9%	8 576	50%	544	6%
Croatia	-6 396	-5 074	-5 670	2.5%	726	11%	-597	-12%
Cyprus	-153	-301	-312	0.1%	-159	-104%	-11	-4%
Czechia	-9 594	1 413	-3 578	1.6%	6 016	63%	-4 991	-353%
Denmark	6 237	-849	-939	0.4%	-7 176	-115%	-90	-11%
Estonia	-5 285	-149	1 783	-0.8%	7 068	134%	1 932	1298%
Finland	-25 843	9 287	9 181	-4.1%	35 023	136%	-107	-1%
France	-25 066	-35 599	-38 854	17.2%	-13 788	-55%	-3 255	-9%
Germany	27 859	68 161	59 895	-26.4%	32 036	115%	-8 266	-12%
Greece	-2 356	-5 260	-4 677	2.1%	-2 322	-99%	582	11%
Hungary	-3 343	-6 918	-5 860	2.6%	-2 517	-75%	1 059	15%
Ireland	811	-231	-65	0.0%	-877	-108%	166	72%
Italy	-5 271	-40 279	-54 391	24.0%	-49 120	-932%	-14 112	-35%
Latvia	-13 531	4 243	3 227	-1.4%	16 758	124%	-1 016	-24%
Lithuania	-4 739	-6 288	-5 730	2.5%	-991	-21%	558	9%
Luxembourg	2	-748	-678	0.3%	-680	-44732%	70	9%
Malta	-10	0	0	0.0%	11	104%	0	82%
Netherlands	3 725	2 781	3 115	-1.4%	-610	-16%	333	12%
Poland	-35 180	-38 504	-35 828	15.8%	-648	-2%	2 677	7%
Portugal	3 572	-769	-2 242	1.0%	-5 814	-163%	-1 473	-192%
Romania	-26 435	-45 836	-46 559	20.6%	-20 123	-76%	-723	-2%
Slovakia	-9 023	-7 317	-7 818	3.5%	1 205	13%	-501	-7%
Slovenia	-4 427	-4 266	-4 323	1.9%	103	2%	-57	-1%
Spain	-36 996	-51 443	-51 478	22.7%	-14 482	-39%	-35	0%
Sweden	-61 077	-35 281	-32 894	14.5%	28 182	46%	2 387	7%
EU-27	**-266 651**	**-209 497**	**-226 476**	**100%**	**40 175**	**15%**	**-16 979**	**-8%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

The overall trend of the LULUCF sector is largely driven by the Forest Land category.

An increase of the forest carbon sink took place during the 90s mainly due to forest area expansion and to an increase of net forest increment, which has been followed by a decline resulting from a combination of different but partly interrelated factors: 1) forest stands are aging with increasing carbon stock and net annual increment is declining; 2) increased harvesting partly as a response to economic drivers and partly as a response to adverse impacts of climate change that have impacted forest health negatively, leading to declining carbon stocks; 3) higher temperatures accelerating decay processes of carbon stored in soils and dead organic matter; and 4) annual rate of afforestation has decreased compared to 50-70 years ago contributing to #1 above.

Inter-annual variations are well assumed in the emission-trend of the LULUCF sector and are mainly related to natural disturbance events. Major wind storms that took place in central-western Europe (e.g,1990, 2000, 2005, 2007 and 2009) and severe wildfires (e.g.,1990, 2003, 2005, 2007, 2017 and 2022) in Mediterranean countries are reflected in Figure 6.1. In recent years, central Europe suffered the effects of droughts that were followed by bark beetle infestations, which required important salvage logging efforts. These events have also contributed to the trend of GHGs in this sector.

Natural disturbances also explain the sharp change in the sink observed in the base year, which result largely from the reporting of Germany. As explained by the Party, in spring 1990, Germany was impacted by a storm that caused an unprecedented number of windfalls (about 70 million m^3 of wood), and this explains the notably low LULUCF sink in 1990 for Germany that is reflected in the EU trend.

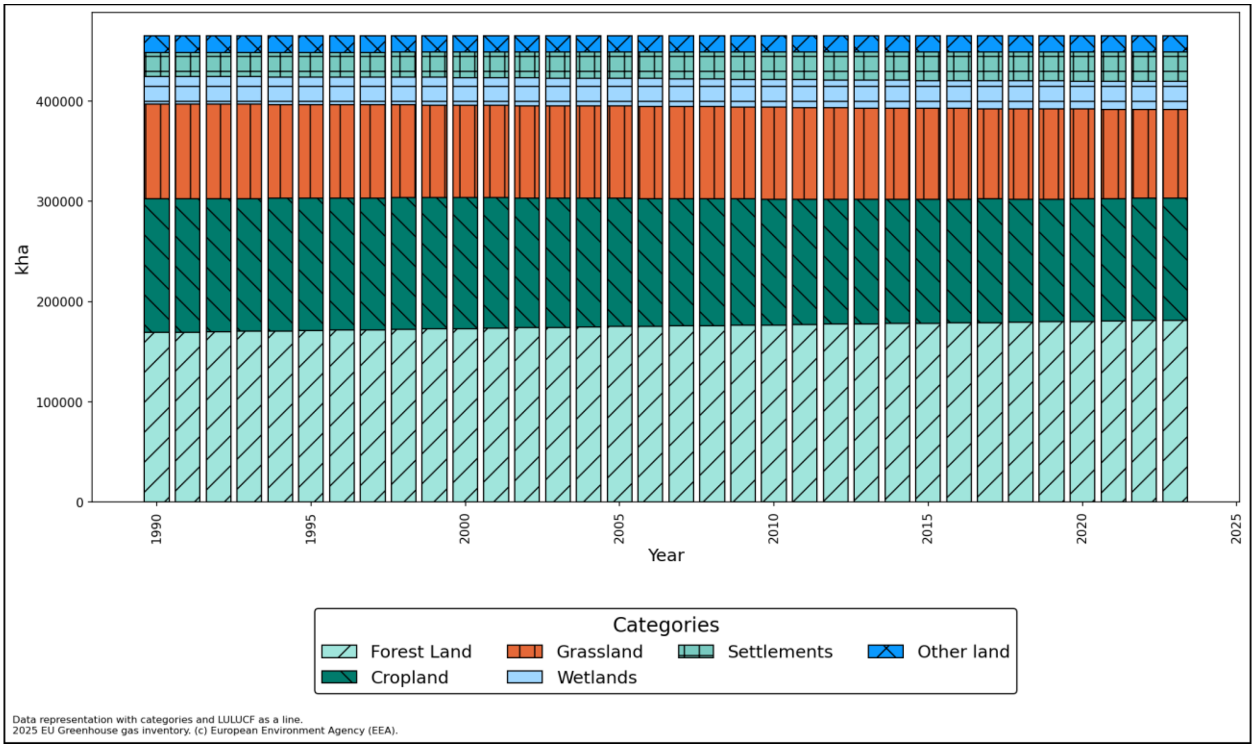
Additional category-specific information on trends and inter-annual variability is provided in the following sections of this chapter.

Although the LULUCF sector results in a net carbon sink at the level of EU, the sector is reported by countries ranging from a net source to a large net sink. Compared to 1990, individual inventories report this year in some cases a significant increase in the carbon sink, while in other cases there is a substantial reduction.

At the EU level, the LULUCF sector offsets about 7% of the total emissions from other sectors (“Total without LULUCF”), with significant differences among MS.

The total reported area in the EU GHG inventory as the sum of the different land use categories is ca. 424 000 kha. The trends on these categories (Figure 6.2) are in line with the trends known from other EU statistics (e.g., Eurostat). However, absolute numbers may be slightly different due to different definitions used under each dataset.

Figure 6.2 Total area for each of the land use categories (kha), as reported by EU MS in 2025.



Source: EU MS submissions 2025, CRT table 4.1

6.1.1 Coverage of pools

LULUCF reporting includes all the carbon pools, living biomass (below and above ground), dead wood, litter and soil carbon in mineral and organic soils as well as harvested wood products. In some case countries report a notation key, NO, NA, NE or IE, as appropriate.

Whenever the Tier 1 assumption of "equilibrium" for carbon stock changes is implemented, countries used the notation key NO, NE, or NA. Efforts have been devoted, and are ongoing to follow a former recommendation from the UN ERT on the use of NA when the assumption of equilibrium is applied. As a result, more MS are now using the notation key NA. Nevertheless, it should be noted a full harmonization on the use of the notation key NA across MS is not possible since some countries have received from their UN ERT a different recommendation on which notation key should be used in this case.Methodological tiers by category

According to EU Governance Regulation (EU) 2018/1999, annex V, part 3, EU member States shall for the period 2021-2025, use at least Tier 1 methodologies in accordance with the 2006 IPCC guidelines for national GHG inventories, except for a carbon pool that accounts for at least 25 % of emissions or removals in a source or sink category which is prioritised within a Member State's national inventory system because its estimate has a significant influence on a country's total inventory of GHGs in terms of the absolute level of emissions and removals, the trend in emissions and removals, or the uncertainty in emissions and removals in the land use categories, in which case, at least Tier 2 methodologies in accordance with the 2006 IPCC guidelines for national GHG inventories shall be used.

Adherence to this requirement is being checked as part of the QA/QC done by the European Environment Agency for all EU Member States. This is an ongoing improvement process.

6.2 Overview of emission trends

In this section we analyze the contribution of the different emission categories to the overall trend of net emissions/removals from the EU LULUCF sector. Table 6.2 shows the different emission categories, their contribution to total net emissions/removals in the EU LULUCF sector and their contribution to the trend 1990-2023 and 2022-2023. A negative share of the trend means that the net emissions in that category are evolving in the opposite direction to those of the EU. Note that while the 1990-2023 trend is less net removals, from -237 MtCO_2e in 1990 to -198 MtCO_2e in 2023, the 2022-2023 trend had more net removals from -183 MtCO_2e in 2022 to -198 MtCO_2 in 2023. This means for the share of 249% for forest land (4.A) for 1990-2023, that forest land removals declined by almost 2.5 times the rate the overall LULUCF removals declined. And the 143% share for forest land for 2022-2023 that forest land removals increased close to 1.5 times the rate the overall LULUCF removals increased. Similarly, the -104% for cropland (4.B) for the period 1990-2023 means that the trend for cropland was opposite the overall trend and corresponds to -104% of the overall trend for this period. Also grassland (4.C) showed a similar trend while settlements (4.E) on the other hand contributed with more emissions for both 1990-2023 and 2022-2023, indicated by first a positive number and then a negative number. Besides forest land, cropland, grassland and settlements that contributed significantly to or against the trend, also harvested wood products (4.G) shows some significant contribution against the trend for 2022-2023, where net removals for this category dropped from -38 MtCO_2 in 2022 to -31 MtCO_2e in 2023.

Table 6.2 Contribution of the different emission categories to the total trend in emissions from the LULUCF sector, compared to the share of emissions of those categories from the total of the sector

Emission category	Contribution to total LULUCF removals/emissions (2023)	Share of trend 1990-2023	Share of trend 2022-2023
4.A	138%	249%	143%
4.B	-17%	-104%	10%
4.C	-7	-74%	46%
4.D	-11%	6%	14%
4.E	-18%	29%	-61%
4.F	-1%	0%	0%
4.G	15%	-4%	-52%

6.3 Land use definitions

6.3.1 Forest land

Table 6.3 Thresholds used for the forest definition

Country	Crown cover (%)	Height (m)	Area (ha)	Minimal width (m)
Austria	30	2	0.05	10
Belgium	20	5	0.5	-
Bulgaria	10	5	0.1	10
Croatia	10	2	0.1	-
Cyprus	10	5	0,3	-
Czechia	30	2	0.05	-
Denmark	10	5	0.5	20
Estonia	30	2	0.5	-
Finland	10	5	0.25	20
France	10	5	0.5	20
Germany	10	5	0.1	-
Greece	25	2	0.3	-
Hungary	30	5	0,5	-
Ireland	20	5	0.1	20
Italy	10	5	0.5	-
Latvia	20	5	0.1	20
Lithuania	30	5	0.1	10
Luxembourg	10	5	0.5	-
Malta	30	5	1	-
Netherlands	20	5	0.5	30
Poland	10	2	0.1	10
Portugal	10	5	1	20
Romania	10	5	0.25	20
Slovakia	20	5	0.3	20
Slovenia	10	5	0.25	-
Spain	20	3	1.0	25
Sweden	10	5	0.5	-

Additional information used by the countries to define the area of forests is provided in the table below:

Table 6.4 Additional qualitative criteria used to define forests complementing quantitative thresholds.

Country	Forest land definition
Austria	Permanently unstocked basal areas that are directly connected with forest in terms of space and forestry enterprise and contribute directly to its management (such as forestall hauling systems, wood storage places, forest glades, forest roads) also represent forests. Areas which are used in short rotation with a rotation period of up to thirty years as well as forest arboretums, forest seed orchards. Christmas tree plantations and plantations of woody plants for the purpose of obtaining fruits such as walnut or sweet chestnut do not account as forests. Rows of trees (except shelter belts for wind protection) and areas with woody plants in a park structure are not forest land.
Belgium	This category includes all land with woody vegetation consistent with thresholds used to define forest land as described in paragraph 6.1 of the NIR. It also includes systems with vegetation that currently fall below, but are expected to exceed, the threshold of the forest land category.
Bulgaria	Areas of natural forest regeneration outside urban areas with a size of more than 0.1 ha also represent “forest”. Forests are also: areas which are in a process of recovering and are still under the parameters, but it is expected to reach forest crown cover over 10% and tree height 5 meters; areas, which as the result of anthropogenic factors or natural reasons are temporarily deforested, but will be reforested; protective forest belts, as well as tree lines with an area over 0.1 ha and width over 10 meters; cork oak stands. City parks with trees, forest shelter belts, and single row trees do not fall under the category “forests.
Croatia	Forest includes land under forest management (forest land without tree cover): Productive Forest land without tree cover, non-productive forest land without tree cover, barren wooded land (e.g., forest roads wider than 3 meters, quarries)
Cyprus	Forests include forest roads, cleared tracts, firebreaks and other small open areas within the forest as well as reforested areas or burnt areas or other areas that temporarily have low plant cover due to human intervention or natural causes, but does not include municipal parks and gardens.
Czechia	Forests exclude the areas of permanently unstocked cadastral forest land, such as forest roads, forest nurseries and land under power transmission lines.
Denmark	Temporarily non-wooded areas, fire breaks and other small open areas, that are an integrated part of the forest, are also included. Christmas trees are also included.
Estonia	All temporarily unstocked forest areas and regeneration areas which have yet to reach a crown density of 30 per cent and a tree height of 2 meters are also included as forest, as are areas which are temporarily unstocked as a result of human intervention such as harvesting, or natural causes (fires, etc.) but which are expected to revert to forest.
Finland	Parks and yards are excluded regardless of whether they meet the forest definition.
France	Forest roads, forest openings less than 20 m wide (e.g., for fire control), windbreaks and forest belts, as well as the poplar plantations and short rotations woody crops, if the criteria for Forest land are met. 5% of France’s European forests are unmanaged on lands such as strong slopes or used for loisir, esthétique, cultural or military. Also, 40% of France’s dependencies Forest land is considered as unmanaged.
Germany	Any area of ground covered by forest vegetation, irrespective of the information in the relevant cadastral survey or similar records. “Forest” also refers to cutover or thinned areas, forest tracks, firebreaks, openings and clearings, forest glades, feeding grounds for game, landings, rides located in the forest, further areas linked to and serving the forest including areas with recreation facilities, overgrown heaths and moorland, overgrown former pastures, alpine pastures, and rough pastures, as well as areas of dwarf pines and green alders. Heaths, moorland, pastures, alpine pastures, and rough pastures are considered to be overgrown if the natural forest cover has reached an average age of five years and if at least 50% of the area is covered by forest. Forested areas of less than 1,000 m2 located in farmland or in developed regions, narrow thickets less than 10 m wide, watercourses up to 5 m wide do not break the continuity of a forest area.
Greece	No additional criteria are used.
Hungary	Forest land (includes FL-FL, L-FL sub-categories) includes areas covered by trees, as well as roads and other areas that are under forest management but that are not covered by trees.
Ireland	All public and private plantation forests. Includes recently clear-felled areas. Tree grown for fruits or flowers, and shrub species (furze, rhododendron) are excluded. Includes open areas within forest boundaries.
Italy	Forest roads, cleared tracts, firebreaks and other open areas within the forest as well as protected forest areas are included in forest. Plantations, mainly poplars, characterized by short rotation coppice system and used for energy crops are included and also other plantation as chestnut and cork oak, have been included in forest land.
Latvia	Young natural stands and all plantations established for the forestry purposes, which have to reach a crown density of 20 % or tree height of 5 m are considered under forest land; as well as the areas normally forming part of the forest area, which are temporarily unstocked as a result of human intervention or natural causes, but which are expected to revert to forest.
Lithuania	Tree lines up to 10 meters of width in fields, at roadsides, water bodies, in living areas and cemeteries or planted at the railways protection zones as well as single trees and bushes, parks planted and grown by man in urban and rural areas are not defined as forests.
Malta	No additional criteria are used.

Country	Forest land definition
Luxembourg	Permanently unstocked basal areas that are directly connected with forest in terms of space and forestry enterprise and contribute directly to its management (such as forestal hauling systems, wood storage places, forest glades, forest roads) also represent forests. Areas which are used in short rotation with a rotation period of up to thirty years as well as forest arboretums, forest seed orchards, Christmas tree plantations and plantations of woody plants for the purpose of obtaining fruits such as walnut or sweet chestnut do not account as forests but represent cropland. Rows of trees (except shelter belts for wind protection) and areas with woody plants in a park structure are not forest land.
Netherlands	The Netherlands has chosen to define the land-use category “Forest Land” as all land with woody vegetation, now or expected in the near future (e.g., clear-cut areas to be replanted, young afforestation areas)
Poland	Young stands and all plantations that have yet to reach a crown density of 10 percent, or a tree height of 2 m are included under forest. Areas normally forming part of the forest area that are temporarily un-stocked as a result of human intervention, such as harvesting or natural causes such as wind-throw, but which are expected to revert to forest are also included.
Portugal	Forests (areas occupied by forests and woodlands which can be used for the production of timber or other forest products) and agro-forestry areas (annual crops or grazing land under the wooded cover of forestry species). The forest trees are under normal climatic conditions higher than 5 m with at least 30% canopy closure.
Romania	It comprises deciduous forest, coniferous forest, mixt forests, clear-cut areas and nurseries, as defined by presence of deciduous trees, coniferous trees, deciduous and resinous trees, dead trees, clear-cuts and forest nursery.
Slovakia	This category includes the land covered by all tree species serving for the fulfilment of forest functions and the lands on which the forest stands were temporarily removed with aim of their regeneration or establishment of forest nurseries or forest seed plantation.
Slovenia	It includes abandoned agricultural land with natural expansion of forest. Abandoned agricultural land on area more than 0.5 ha, which have been abandoned for more than 20 years, with minimal tree height 5.00 m and have a tree crown cover between up to 75 % are defined as forests.
Spain	Any land having woody vegetation with no agricultural use/activities fulfilling the threshold of forest and any other land which is expected achieve these parameters (including for “dehesa” where tree cover meets the thresholds)
Sweden	Land which hosts a potential yield of stem-wood exceeding one cubic meter per hectare and year. Meanwhile, the Land which hosts a potential yield of stem-wood lower than one cubic metre per hectare and year are classified as mire (under Wetlands). Permanent forest roads (width>5m) are not considered as forest land. All country forests are considered managed.

6.3.2 Cropland

Table 6.5 Definitions of lands included under the category 4B: Cropland.

Country	*Definition*
Austria	Arable land, including annual and perennial crops (rotation period of up to thirty years), as well as forest arboretums, forest seed orchards, Christmas tree plantations and orchards (e.g., walnut, or sweet chestnut) and rows of trees and areas with woody plants in parks and green areas, and house garden.
Belgium	Tillage land and agroforestry systems with vegetation falling below the thresholds for forests.
Bulgaria	Cropland consists of annual crops (cornfields and kitchen gardens) and perennials (vineyards, fruit and berry plantation and nurseries). Arable land is the land worked regularly, generally under a system of crop rotation - area with annual crops, set - aside area as well as area with seeds and seedlings. Perennial crops include fruit and berry plantation, vineyards and other permanent crops, nurseries for wine, fruits, ornamental plants, forest trees etc. The orchard is a uniformly kept plantation (by annual pruning and regular treatment for protection from diseases and insects) of fruit trees (pip- trees, stone-trees and nut-trees).
Croatia	Cropland category includes non-irrigated arable land, permanently irrigated arable land, vineyards, fruit trees and berry plantations, olive groves, annual crops associated with permanent crops (Complex cultivation patterns).
Cyprus	This category contains cropped land, including lands with woody vegetation (i.e., fruit trees) where the vegetation does not meet the definition of forest. In particular, this category includes land principally occupied by agriculture, including arable land, annual and permanent crops as well as vineyards, fruit trees and berry plantations, olive groves and other similar types of cultivation.
Czechia	Cropland is predominantly represented by arable land (92.6%), while the remaining area includes hop-fields, vineyards, gardens and orchards.
Denmark	Annual crops, wooden perennial crops, hedgerows and “other agricultural area” (i.e., small undefined areas lying inside the cropland area). It includes farmlands, commercial plantations with perennial crops (fruit trees, orchards and willow), house gardens, hedgerows (perennial trees/bushes not meeting the forest definition) in the agricultural landscape, as well as willow plantations on agricultural land for bioenergy purposes.
Estonia	Cropland is arable land, area where annual or perennial crops are growing (incl. fallow, orchards, short-term and long-term cultural grasslands and temporary greenhouses). It does not include built garden land under 0.3 ha (that is included in Settlements). Abandoned cropland is classified as cropland until it has not lost arable land features – changes in soil and vegetation have not taken place and the land is still usable as cropland without the implementation of specific treatments.
Finland	Arable crops, grass covered (for less than 5 years), set-aside, permanent horticultural crops, greenhouses, and kitchen gardens.
France	Annual crops, temporary pastures (which last for maximum 6 annual harvests) and permanent crops (orchards, vineyards, olives, etc.).
Germany	Annual crops and cropland with perennial crops (long-lived crops: fruit crops, osiers, poplars, Christmas tree farms, nurseries) and lands for cultivation of vegetables, fruit and flowers.
Greece	Annual and perennial crops, temporary fallow land and perennial woody crops, i.e., tree crops and vineyards.
Hungary	Cropland contains arable lands, vegetable gardens, orchards and the vineyard areas, as well as set-aside croplands. Arable lands are any land area under regular cultivation irrespective of the rate or method of soil cultivation and whether the area is under crop production or not due to any reason, such as temporary inland waters or fallow. Areas under tree nurseries (including ornamental and orchard tree nurseries, vineyard nurseries, forest tree nurseries excluding those for the own requirements of forestry companies grown in the forest), permanent crops (e.g., alfalfa and strawberries), herbs and aromatic crops are included. Vegetable gardens are areas around residential houses where, in addition to meeting the owners’ demand may produce some surplus of low amount which is usually traded. Orchards are land under fruit trees and bushes that may include several fruit species (e.g.: apples, pears, cherries, etc.). Included are non-productive orchards and orchards of systematic layout in vegetable gardens if the area is 200 m² or above in case of berries and 400 m² or above in case of fruit trees. Vineyards are areas where grapes are planted in equal row width and planting space and include non-productive areas and vineyards in vegetable gardens (e.g., trellises) if grapes are planted in equal row width and planting space, and the size of the area is at least 200 m². Set-aside cropland is land that is abandoned but not converted to any other land use.
Ireland	Permanent crops and tillage land, including set-aside, as recorded by annual statistics.
Italy	Annual crops and perennial woody crops (e.g., woody plantations, that don’t meet national forest definition, olive groves or vineyards).
Latvia	The cropland refers to the area of arable land, including orchards and extensively managed arable lands. Cropland also includes animal feeding glades, which according to national land use classification belong to forest land.
Lithuania	The area of cropland comprises of the area under arable crops as well as orchards and berry plantations. Arable land is continuously managed or temporary unmanaged land, used and suitable to use for cultivation of agricultural crops, also fallows, inspects, plastic cover greenhouses, strawberry and raspberry plantations, areas for production of flowers and decorative plants. Arable land set aside to rest for one or several years (<5 years) before being cultivated again as part of an annual crop-pasture rotation is still included under cropland. Orchards and berry plantations are areas planted with fruit trees and fruit bushes (apple-trees, pear-trees, plum-trees, cherry-trees, currants, gooseberry, quince and others).

Country	*Definition*
Luxemburg	Agro-forestry systems where tree cover falls below the forest thresholds, respectively covered by permanent crops, annual crops, artificial meadows (not permanent) and lands temporarily set aside.
Malta	In Malta cropland can be split into three types: arable area which is cultivated under a system of crop rotation; kitchen gardens that include small plots of cultivated land, in which most of the products are intended for consumption by the farmer; land under permanent crops where the crop occupies the same land for a period of time, normally 5 years or more. For inventory purposes, local cropland was split into two: annual crops and perennial woody crops. The main perennial crops considered for this inventory are vines, being the most cultivated crop.
Netherlands	Arable and tillage land, including rice-fields, and agro-forestry systems where the vegetation structure falls below the thresholds for forest and nurseries (including tree nurseries).
Poland	Agricultural land considered as cropland consists of arable land includes land, which is cultivated, i.e., sowed and fallow land. Arable land should be maintained in good agricultural condition. Cultivated arable land is understood as land sowed or planted with agricultural or horticultural products, willow and hops plantations, area of greenhouses, area under cover and area of less than 1000 m^2, planted with fruit trees and bushes, as well as green manure, fallow land includes arable land which are not used for production purposes but are maintained in good agricultural condition; orchards include land with the area of at least 1000 m^2, planted with fruit trees and bushes.
Portugal	Rain-fed annual crops (without irrigation and fallow-land integrated into crop-rotations), irrigated annual crops (under irrigation, greenhouses), rice cultivation lands, wine yards, olives and other species of woody crops
Romania	Cropland includes agricultural lands, i.e., lands covered or temporary uncovered by agricultural crops (major crops and horticultural plants cultures). It includes 3 groups (non-woody crops, woody crops and other wooded land and trees outside forests (which do not meet the forest definition parameters, e.g., forest belts which are narrower than 20m) with 9 categories: orchard, vineyard, shrubs, cultivated land agricultural, temporary fallow land, deciduous tree, coniferous tree, deciduous and resinous trees and dead trees.
Slovakia	Cropland includes lands for growing cereals, root-crops, industrial crops, vegetables and other kinds of agricultural crops; perennial woody crops; lands temporary overgrown with grass or used for growing of fodder lasting several years; hotbeds and greenhouses if they are built up on the arable land; fallow land which is arable land left for regeneration for one growing season during which were not sow specific crops or just crops for green manure, eventually it is covered by spontaneous vegetation, which would be ploughed in.
Slovenia	Annual: arable land breeds more than 2 meters and grows the non-woody vegetation (cereals, potatoes, forage crops, vegetable crops, oilseed, ornamental plants, herbs, strawberries, hop fields) and agricultural fallow ground. Also, temporary meadows and greenhouses. Perennial: permanent crops on arable land such as vineyards, extensive and intensive orchards, olive groves, nursery (for grapevines, fruit and forest trees), forest plantations and forest trees on agricultural land.
Spain	Annual crops and fallow land, perennial crops (olive groves, wines and other woody crops) and mix of annual and permanent crops (except when they qualify as forest land, i.e., in “dehesa”).
Sweden	Regularly tilled agricultural land.

6.3.3 Grassland

Table 6.6 Definitions of lands included under the category 4C: Grassland.

Country	*Definition*
Austria	Meadows cut once/twice/several times, cultivated pastures, litter meadows, rough pastures, alpine meadows and pastures and abandoned grassland.
Belgium	Rangelands and pastureland that is not considered under cropland. It also includes systems with vegetation that fall below the threshold of forest land category and are not expected to exceed it, without human intervention.
Bulgaria	Grassland includes the permanent grasslands – natural meadows, low productive grasslands, permanent lawns and grassland which are not used for production purposes.
Croatia	Grassland includes pastures, land principally occupied by agriculture, with significant areas of natural vegetation, natural grasslands, moors and heathland, sclerophyllous vegetation.
Cyprus	This category includes rangelands and pastureland that are not considered Cropland. It also includes systems with woody vegetation and other non-grass vegetation such as bushes and sclerophyllous vegetation that fall below the threshold values used in the Forest Land category. The category also includes all pastures, natural grassland and scarcely vegetated areas.
Czechia	Grassland as defined in this inventory is mostly used as pastures for cattle and meadows for growing feed. Additionally, the fraction of permanently unstocked cadastral FL is also included under Grassland. This is because it predominantly has the attributes of Grassland (such as land under power transmission lines).
Denmark	Land defined as grazing land under LPIS, heath land which may or may not be used for sheep grazing, as well as all other areas not meeting the definitions of forest land. The area of grassland is divided in “grazing land” and “other grassland”.
Estonia	Grassland includes rangelands and pasture, land that is not considered cropland nor forest land: land with perennial grasses that is proper for mow and pasture, smaller fallows and former cultural grasslands that have

Country	Definition
	lost arable land features and grassland from wild lands (natural grassland). Overgrown wooded pasture with canopy cover between 30 and 50% is classified as grassland or forest, depending on the mainland-use purpose. The national land cover class 'bushes' (area covered with natural or wildered cultivated bush and shrub species where canopy cover is over 50%) is included into GL.
Finland	Grassland includes areas of extensive grass, ditches associated with agricultural land, areas of bioenergy plants and abandoned arable land. In this context, abandoned arable land refers to fields that are no longer used for agricultural production and where natural reforestation is possible or is already taking place.
France	Land covered by natural and seeded herbaceous for more than 5 years. Includes areas covered trees and bushes being under the forest definition or not included under land category.
Germany	Meadow and pasture areas that cannot be considered cropland. Includes land covered with trees and shrubs that does not fall within the definition of "forest", as well as natural grassland and recreational areas.
Greece	Rangeland and pasture with vegetation that falls below the threshold of national forest definition and are not expected to exceed that without human intervention. Pastures that have been fertilized or sown are considered as cropland.
Hungary	Grassland includes meadows, i.e., land under grass (artificial planting included) where the production is utilized by cutting, irrespective of whether it is used for grazing sometimes, and pasture, i.e., land under grass (artificial planting included) that is utilized for grazing irrespective of whether it is used for cutting sometimes. Grassland includes areas with trees which are utilized for grazing and unmanaged grasslands which are not in use for agricultural purposes.
Ireland	Improved grassland (pasture and areas used for the harvesting of hay and silage) and unimproved grassland (rough grazing) in use as recorded by annual statistics.
Italy	Grazing lands, forage crops, permanent pastures, and set-aside lands since 1970, all shrub lands (data derived from NFI) and other woodlands that do not fulfil forest definition.
Latvia	The grassland category consists of lands used as pastures, as well as glades and bushland which do not fit to forest definition, vegetated areas on non-forest lands complying to forest definition where land use type can be easily switched back to grassland without legal requirement of transformation of the land use, but except grassland used in forage production and extensively managed cropland.
Lithuania	Grassland includes meadows and natural pastures planted with perennial grasses or naturally developed, on a regular basis used for moving and grazing. Grasslands cultivated for less than 5 years, in order to increase ground vegetation, still remain grasslands.
Luxemburg	All grasslands that are not considered as cropland including systems with vegetation or tree cover below forest threshold, natural grassland, recreational areas as well as agricultural systems. It includes one cut meadows; two and more cut meadows, cultivated pastures, litter meadows, rough pastures and pastures and abandoned grassland.
Malta	This category is split into other grassland and maquis. On the basis of expert judgement, it was decided that maquis will be included in this category. The data of this category was derived from the Corine Land Cover 1996, 2000, 2006 under the sclerophyllous vegetation and Grassland.
Netherlands	Under Grassland (non-TOF) any type of terrain which is predominantly covered by grass vegetation is reported. It also includes vegetation that falls below the threshold used in the forest land category and is not expected to exceed the threshold used in the forest land category. It is further stratified in: 'Grassland vegetation', 'Nature', 'Orchards'. Trees outside forests (TOF) are wooded areas that comply with the forest definition except for their surface area (< 0.5 ha or less than 30 m width). These represent fragmented forest plots as well as groups of trees in parks and nature terrains and most woody vegetation lining roads and fields.
Poland	Grassland consists of permanent meadow and pastures include land permanently covered with grass, but does not include arable land sown with grass as part of crop rotation; permanent meadow is understood as the land permanently covered with grass and mown in principle in mountain area; also, the area permanent pastures are understood as the land permanently covered with grass not mown but grazed in principle in mountain area; also the area of grazed pastures and meadows.
Portugal	Lands covered by permanent herbaceous cover.
Romania	Grassland includes land whose destination is grazing or mowing hay for livestock production, as well as other wooded land and trees outside forests (which do not meet forest definition parameters, e.g., forest belts which are narrower than 20m). It includes pastures, hayfields in hilly and mountainous areas and meadows in lowlands.
Slovakia	This category includes permanent grasslands and meadows used for the pasture or hay production, which is not considered as cropland.
Slovenia	Agricultural areas grown by grass and other herbs that are regularly cut or grazed. These areas are not in tillage or fallow ground. Included are areas covered with some of forest trees (less than 50 trees/ha) and the alpine pastures too. In this class there are swamp pastures and meadows on organic or mineral-organic soils, where the groundwater rises few times in the year. It includes also uncultivated agriculture land.
Spain	Pastureland, including grazing land not included in cropland. It includes also pastures and meadows in the dehesa (forested pasture) that do not comply with the definition of forest.
Sweden	Agricultural land that is not regularly tilled. This corresponds to natural grazing land. All grasslands are assumed managed.

6.3.4 Wetlands

Table 6.7 Definitions of lands included under the category 4D: Wetlands.

Country	*Definition*
Austria	Rivers, lakes, mires and peat areas (protected areas, in general) as classified by national statistical system.
Belgium	Land covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into the other land category. It includes reservoirs as a managed subdivision and natural rivers and lakes as unmanaged subdivisions.
Bulgaria	Wetlands category - wetlands surface water areas are included (wetlands) – covered with water or water saturated lands (throughout the year or partially in the year) which does not fall in the other categories. These are natural or artificial watercourses serving as water drainage channels, natural or artificial stretches of water, coastal lagoons, wetlands areas and peatbogs.
Croatia	Inland marshes, salt marshes, salines, intertidal flats, water courses, water bodies, coastal lagoons
Cyprus	This category contains areas of land that is covered or saturated by water for all or part of the year and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. In particular, it contains inland and salt marshes, water courses and water bodies.
Czechia	Category Wetlands includes riverbeds, and water reservoirs such as lakes and ponds, wetlands and swamps.
Denmark	Permanent wetlands, wetlands for peat extraction and re-established anthropogenic wetlands. Several subdivisions may be distinguished: unmanaged fully water covered wetlands (lakes and rivers); unmanaged partly water covered wetlands (fens and bogs); managed drained land for peat extraction; managed partly water covered wetlands (re-established wetlands on primarily former cropland and grassland).
Estonia	Land permanently saturated by water and/or areas where the peat layer is at least 30 cm, and the minimum potential tree height does not conform to the forest land definition. It does include smaller bog holes.
Finland	Inland waters (reservoirs, natural lakes and rivers), peat extraction areas and peatlands which do not fulfil the definition of other land uses.
Germany	Reporting in the wetlands category primarily covers emissions from organic soils that are released during peat extraction, covering: CO_2 losses from extraction areas, and during extraction and spreading of peat. Also, it includes (but they are not estimated) the few non-drained semi-natural bogs that have been largely free of anthropogenic impacts, flooded lands, water-storage facilities (dams, reservoirs, etc.) and settling basins that are used for energy production, irrigation, shipping and recreation, and that are flooded or drained, or that otherwise have large water-level fluctuations.
Greece	Land that is covered or saturated by water for all or the greatest part of the year (e.g., lakes, reservoirs, marshes), riverbed (including torrent beds) and that does not fall into the forest land, cropland, grassland or settlements categories.
France	Lands covered or saturated by water all year long or part of it.
Hungary	Wetland includes the wetlands and water bodies as defined by the CORINE land-cover databases and contain inland marshes (low-lying land usually flooded in winter, and more or less saturated by water all year round), peat bogs (peat land consisting mainly decomposed moss and vegetable matter), water courses (natural or artificial watercourses including those serving as water drainage) and water bodies (natural or artificial lakes, ponds etc.).
Ireland	Natural unexploited wetlands and areas commercially exploited for public and private extraction of peat and areas used for domestic harvesting of peat.
Italy	Lands covered or saturated by water, for all or part of the year, have been included in this category (MAMB, 1992). Reservoirs or water bodies regulated by human activities have not been considered.
Latvia	Wetlands category includes all inland water bodies (rivers, ponds, and lakes), swamps (constantly wet areas where height of trees cannot reach more than 5 m in height and ground vegetation consists mostly of sphagnum and different sword grasses), flood-lands (small areas) and alluvial lands (larger flood-lands).
Lithuania	Wetlands include peat extraction areas and peat lands which do not fulfil the definition of other categories. Water bodies and swamps (bogs) are also included under this category. Peat extraction areas are considered as managed land.
Luxemburg	Land that is covered or saturated by water for all or part of the year (e.g., peat land, reservoirs) and that does not fall into other categories.
Malta	In the Maltese islands wetlands are mostly saline.
Netherlands	Land covered or saturated with water for all or part of the year and does not fall into the other land category. It includes reservoirs as a managed sub-division and natural lakes and rivers as unmanaged, including natural open water in rivers, but also man-made open water in channels, ditches and artificial lakes.
Poland	Wetland consists of marine internal; surface flowing waters, which covers land under waters flowing in rivers, mountain streams, channels, and other water courses, permanently or seasonally and their sources as well as land under lakes and artificial water reservoirs. from or to which the water course flow; land under surface lentic water which covers land under water in lakes and reservoirs other than those described above, land under ponds including water reservoirs (excluding lakes and dam reservoirs for water level adjustment) including ditches and areas adjacent and related to ponds; land under ditches including open ditches acting as land improvement facilities for land used.

Country	*Definition*
Portugal	Inland wetlands, coastal wetlands, salt marshes, saline and intertidal flats.
Romania	Wetlands includes all lands covered by water (rivers, ponds, dams, swimming pools, etc.) and land affected by humidity (caused by water stagnation, marshy areas, etc.), with the exception of agricultural land. It contains two sections (waters and wetlands) and 11 categories (permanent streams, temporary streams, lakes, dams, floating vegetation, hydrophilic vegetation (stubble etc.), harbours, temporarily flooded areas, bogs, channels and piers.
Slovakia	The wetlands include artificial reservoirs and dam lakes, natural lakes, rivers and swamps.
Slovenia	Wetlands are defined as land that is temporarily or permanently saturated by water. Wetlands include lands such as fens, marshes, bogs and reeds and are not under agricultural use. Inland water bodies (major rivers, lakes and water reservoirs) are also part of Wetlands. Although there are small areas of raised bogs, all Wetlands are assumed managed.
Spain	Includes the lands covered or saturated by water all year long or part of it.
Sweden	Wetlands is assumed unmanaged (mires and areas saturated by fresh water) and managed (cca 10 000 ha used for peat extraction).

6.3.5 Settlements

Table 6.8 Definitions of lands included under the category 4E: Settlements.

Country	*Definition*
Austria	Includes buildings land: sealed, partly sealed and unsealed areas; parks and gardens; roads and railway tracks; excavation areas, and other not further differentiated settlement area.
Belgium	All developed land, including transportation infrastructure and human settlements of any size (i.e., including roadsides) unless they are already included under other categories.
Bulgaria	The Settlements refer to all classes of urban formation. These are areas that are functionally or administratively associated with public or private land in cities, villages or other settlement types.
Croatia	Continuous and discontinuous urban fabric area, industrial or commercial units, road and rail networks and associated land, port areas, airports, mineral extraction sites, dump sites, construction sites, green urban areas, sport and leisure facilities.
Cyprus	All developed land, including transportation infrastructure and human settlements of any size. It contains industrial and commercial units, urban areas, port areas, airports, construction, mineral extraction and waste dump sites.
Czechia	Settlements include two categories built-up areas and courtyards and other lands. Other lands include all types of land-use were included with the exception of “unproductive land”, which corresponds to category 4.F Other Land. Hence, the Settlements category also includes all land used for infrastructure, as well as that of industrial zones and city parks.
Denmark	Urban cores, industrial areas, roads, high and low build-up areas. Low build-up areas are characterized as single-family houses surrounded by gardens, graveyards, sports facilities, etc. (estimates are reported only for low build-up areas).
Estonia	Built-up areas, with roads, streets and squares, traffic and power lines, urban parks, industrial and manufacturing land, sports facilities, airports, legal waste down points, construction sites and buildings with up to 0.3 ha of garden yard (including permanent greenhouses), and open cast areas (except peat extraction areas) are included into this land-use category
Finland	Combined area of NFI built-up land, traffic lines and power lines. Includes parks, yards, farm roads and barns.
France	Artificialized land (settlements, parks, roads and infrastructure, etc.).
Germany	Open settlement and transport areas.
Greece	Developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other land-use categories.
Hungary	Settlements comprises the urban areas, industrial, commercial and transport units, as well as mines, dump and construction sites and artificial non-agricultural vegetated areas.
Ireland	Urban areas, roads, airports and the footprint of industrial commercial/institutional and residential buildings.
Italy	Artificial surfaces, transportation infrastructures (urban and rural), power lines and human settlements of any size, comprising also parks.
Latvia	According to national definitions settlements include land under buildings including yards and gardens as well as land necessary to maintain and to access those buildings; land under roads including buffer zones; forest infrastructure excluding ditches and other wetlands, but including seed orchards, forest nurseries and firebreaks; other infrastructure – buffer zones of industrial networks, quarries etc.
Lithuania	All urban territories, power lines, traffic lines and roads are included under this category as well as orchards and berry plantations planted in small size household areas and only used for householders’ meanings.

Country	Definition
Luxemburg	Developed land, including transportation and any size of human settlement unless already included under other category.
Malta	The land-use category Settlements includes all classes of urban tree formations, namely trees grown along roads and streets, in public and private gardens, and in cemeteries, airports, construction sites, dumpsites, industrial or commercial units, port areas and sport and leisure facilities.
Netherlands	Developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.
Poland	Settlements consists of: residential areas include land not used for agricultural and forest production, put under dwelling buildings, devices functionally related to dwelling buildings (yards, drives, passages, playgrounds adjacent to houses), as well as gardens adjacent to houses; industrial areas include land put under buildings and devices serving the purpose of industrial production; other built-up areas include land put under buildings and devices related to administration; undeveloped urbanised areas include land that is not built over, allocated in spatial management plans to building development and excluded from agricultural and forest production; recreational and resting areas comprise the following types of land not put under buildings; areas of recreational centres,. children playgrounds, beaches, arranged parks, squares, lawns (outside street lanes); areas of historical significance: ruins of castles, strongholds, etc.; sport grounds: stadiums, football fields, ski-jumping take-offs, toboggan-run, sports rifle ranges, public baths etc.; area for entertainment purposes: amusement, grounds, funfairs etc.; zoological and botanical gardens; areas of non-arranged greenery, not listed under woodlands or land planted with trees or shrubbery; transport areas including land put under: roads; stopping yards next to railway stations, bus stations and airports, maritime and river ports and other ports, as well as universal accesses to unloading platforms and storage yards; railway grounds; other transport grounds.
Portugal	Includes all artificial territories, including cities and villages, industry, roads and railway, ports and airports.
Romania	Settlements has 3 groups (urban/rural, buildings and infrastructure) and includes: fenced and constructed areas, sealed lands (e.g., car parks, roundabouts, platforms), urban/rural lawns, playgrounds in green areas, beach lawn and other areas with lawn, dwellings, industrial and administration buildings (e.g., banks, churches, railway stations, restaurants), warehouses, huts, ruins, greenhouses, graveyards, dirt roads, trails, rail roads and roads (street, sidewalk, square), bridges and dams.
Slovakia	The settlements include all developed land, including transportation infrastructure and human settlements of any size.
Slovenia	Settlements are all piece of land where the buildings, roads, parking places, mines, stone pits and all other infrastructure are in human use.
Spain	All developed land, transport infrastructure and establishments of any size, unless they are included in other categories.
Sweden	Infrastructure such as roads and railways, power lines, municipality areas, gardens and gravel pits.

6.3.6 Other land

Table 6.9 Definitions of lands included under the category 4F: Other land.

Country	Definition
Austria	Area with i) rocks and screes, ii) glaciers and iii) unmanaged alpine dwarf shrub heaths. It is calculated as the difference of total country area and all other land uses, showing max 2% difference by relevant cadastral data.
Belgium	Bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five categories.
Bulgaria	Other land category includes bare soil, rock and all area that do not fall into any of other five land-use categories.
Croatia	Other land category represents a difference between the total area of Croatia and sum of all other land use categories.
Cyprus	Bare soil, rock, beaches, dunes and sand plains and all land areas that do not fall into any of the other five categories.
Czechia	Other land is not represented by any land use category within the Czech conditions and the national system of land use representation and land use change identification.
Denmark	Unmanaged area like moors, fens, beaches, sand dunes and other areas without human interference.
Estonia	Land areas that do not fall into any of the other five land-use categories.
Finland	Mineral soils on poorly productive forest land, which do not fulfil the threshold values for forest, unproductive lands on mineral soils on rocky lands and treeless mountain areas.
France	All lands that do not correspond to any other land use categories (e.g., rock areas). Other lands (flush rocks, etc.) cover around 0.9 million hectares, and are the lowest source of emissions due to low soil disturbance. This is land with no significant carbon stock, neither in soils nor in biomass.
Germany	Waste and swaths/aisles, glacier areas, scree slopes and sand bars and other land which cannot be allocated under other land categories. "Other land" consists of areas that are neither influenced nor cultivated by people.

Country	*Definition*
Greece	All land areas that do not fall into any of other land-use categories (e.g., rocky areas, bare soil, mine and quarry land).
Hungary	Other Land includes comprises any area not included in another categories.
Ireland	Residual lands that are determinate when all other land use areas have been determined.
Italy	Other Land includes comprises any area not included in another categories. It is included to match overall consistency of country land area.
Latvia	According to the national land use statistics other lands include unmanaged lands, wetlands and settlements (1 459.3 mill. ha in 2008). Instead of the official statistics since 2009 the NFI is used to estimate area of other lands. It is assumed that other lands are dunes not covered by woody vegetation.
Lithuania	All other land which is not assigned to any other category such as quarries, sand - dunes and rocky areas is defined as Other land.
Luxemburg	This category includes bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five categories. It allows the total of identified land areas to match the national area.
Malta	This category includes bare soil, rock, and all unmanaged land areas that do not fall into any of the other five categories. Mineral extraction sites in Malta are included under this land-use category.
Netherlands	Surfaces of bare soil which are not included in any other category like: bare sands and the earliest stages of succession from sand in the coastal areas (beaches, dunes and sandy roads) or uncultivated land alongside rivers. It does not include bare areas that emerge from shrinking and expanding water surfaces (which are included in wetlands).
Poland	Other Land includes comprises any area not included in another categories. It is included to match overall consistency of country land area.
Portugal	Shrubland - includes all lands covered in woody vegetation that do not meet the forest or permanent crop definitions and Other land - includes all lands that do not meet the previous definitions, such as lands covered in rocks, sand dunes, etc.
Romania	Other land includes following categories: rocky areas, excavations, stone quarries (active, closed), stony debris, gravel/sand/earth pits, drilling perimeters and locally degraded lands.
Slovakia	Other land represents bare soil, rock and all unmanaged land areas that do not fall into any of the other categories.
Slovenia	Other land includes non-forest land covered with vegetation lover than 2 m or covered less than 75%, which is not used in agriculture. There are inbuilt areas with little or no vegetation as rocks, sands, sand banks (bigger than 5000 m2), waste and other opened areas. This is all land that is not classified in other land use definitions.
Spain	Bare soil, rock areas, ice and other areas of land that do not fall into any of the other land category.
Sweden	Waste land and most of the mountain area in northwest Sweden. It is assumed unmanaged.

6.4 Source categories and methodological issues

6.4.1 Country-specific approaches

Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

Most EU Member States use several land-use datasets for representing land, this includes national datasets as well as EU datasets such as Corine Land Cover and the Land Parcel Information System (LPIS). Some Member States use data from their National Forest Inventory for the forest land category and in a few cases, it also covers non-forest land.

Most Member States have a national soil sampling survey with less frequent sampling allowing identification of mineral and organic soils.

Information on approached used for natural disturbance

The EU GHG inventory includes all emissions and removals on managed land regardless of whether fluxes can be attributed to a natural disturbance event.

Information on approaches used for reporting harvested wood products

The methods and data sources for estimating carbon stock changes in HWPs are consistent with methodologies provided by 2006 IPCC GL. Individual inventories implement the IPCC Approach B (i.e., production approach) to provide estimates on HWPs consistently with the reporting of the carbon pool under the and subsequently according to EU Regulations No 2018/841.

6.4.2 Category: Forest land (CRT 4.A)

6.4.2.1 Overview of the Forest land category

Forest land category is by large the main driver in the LULUCF sector. In terms of area, it represents about 40% of the entire territory. Based on individual submissions reported this year, total forest area reached 169 105 kha in 2023, which represents an increase of 7.8% as compared with 1990.

About 5.8% of the total forest area is represented by lands under conversion to forest land. This trend of increasing forest land area, which is also reflected in different official statistics of the EU, is a result of the expansion of forests due to less grazing pressure and the abandonment of agricultural activities, which promote natural forest expansion. But an important driver behind the forest area increase has been also the promotion of national afforestation programs, including grant-aid.

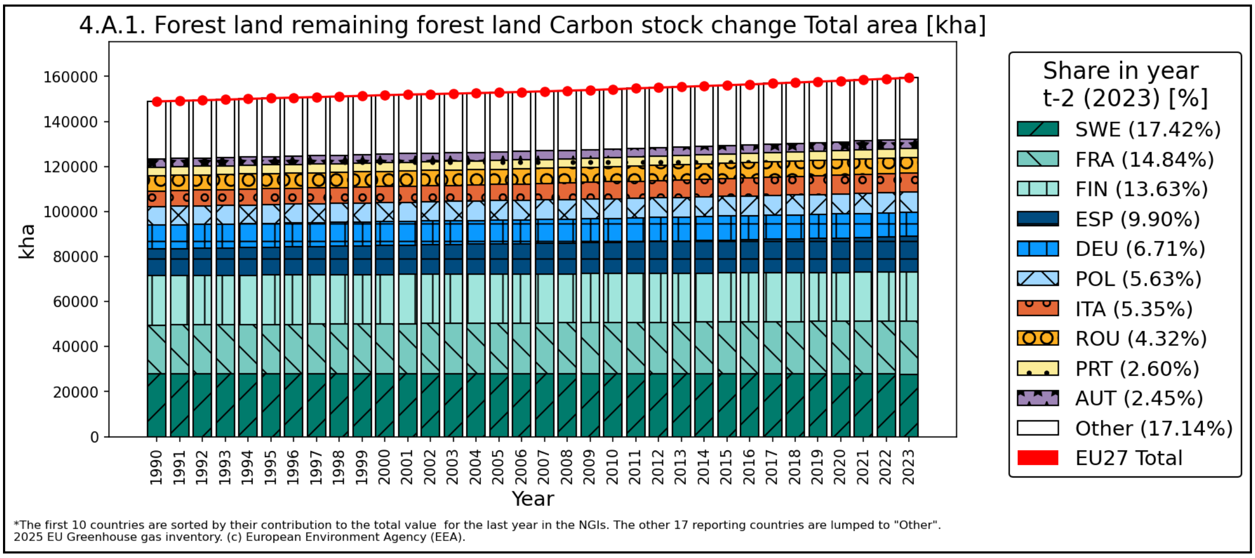
The largest forest areas are reported by Sweden, France and Finland, which together report about 46% of the total forest area at EU level (Figure 6.3). Deforestation does not appear to be a major issue in Europe. Moreover, the absolute area under conversion from forest is by far compensated by new afforested areas and natural forest expansion.

6.4.2.2 Forest Land remaining Forest Land (CRT 4A1)

Overview of Forest Land remaining Forest Land category

As with the main category, the area of Forest Land remaining Forest Land reported for the inventory year increased by 7% as compared with 1990. However, at the level of individual submissions there are significant differences.

Figure 6.3 Trend of activity data in subcategory 4A1 “Forest land remaining Forest Land” in EU



For this inventory year, the total land area reported under the sub-category 4.A1 by EU MS reached 159 361 kha, out of which about 83% is attributed to the 10 MS with the higher contribution.

In terms of GHG emissions the category 4.A1 resulted in a net sink of -223 878 kt CO_2, decreasing by 31% as compared to 1990. The largest contributors are Italy, Poland, France Spain and Sweden (Table 6.10).

Table 6.10 4A1 Forest Land remaining Forest Land: EU contributions to net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	-10 624	311	6 763	-3.0%	17 387	164%	6 452	2075%
Belgium	-1 907	-1 323	-1 302	0.6%	605	32%	21	2%
Bulgaria	-13 584	-8 186	-8 181	3.7%	5 403	40%	5	0%
Croatia	-6 469	-4 999	-5 546	2.5%	923	14%	-547	-11%
Cyprus	2	-159	-169	0.1%	-170	-10977%	-9	-6%
Czechia	-8 136	4 136	-1 496	0.7%	6 639	82%	-5 632	-136%
Denmark	-232	-1 851	-2 689	1.2%	-2 457	-1061%	-837	-45%
Estonia	-5 927	-1 666	409	-0.2%	6 336	107%	2 075	125%
Finland	-31 689	495	-1 105	0.5%	30 585	97%	-1 599	-323%
France	-24 718	-31 657	-36 165	16.2%	-11 447	-46%	-4 508	-14%
Germany	-25 944	18 942	21 076	-9.4%	47 020	181%	2 134	11%
Greece	-1 310	-2 147	-1 680	0.8%	-370	-28%	466	22%
Hungary	-3 021	-5 233	-4 698	2.1%	-1 677	-55%	534	10%
Ireland	-2 403	1 259	1 054	-0.5%	3 456	144%	-206	-16%
Italy	-15 002	-33 491	-41 466	18.5%	-26 464	-176%	-7 975	-24%
Latvia	-17 548	727	183	-0.1%	17 731	101%	-544	-75%
Lithuania	-6 004	-4 784	-4 551	2.0%	1 453	24%	234	5%
Luxembourg	-10	-682	-609	0.3%	-599	-5915%	73	11%
Malta	0	0	0	0.0%	0	62%	0	2%
Netherlands	-1 396	-1 360	-1 361	0.6%	36	3%	-1	0%
Poland	-32 607	-32 464	-38 099	17.0%	-5 492	-17%	-5 635	-17%
Portugal	4 455	1 111	-159	0.1%	-4 614	-104%	-1 271	-114%
Romania	-25 005	-26 108	-27 419	12.2%	-2 414	-10%	-1 311	-5%
Slovakia	-5 999	-6 305	-6 672	3.0%	-673	-11%	-367	-6%
Slovenia	-4 587	-3 964	-4 072	1.8%	515	11%	-108	-3%
Spain	-22 509	-32 317	-32 610	14.6%	-10 101	-45%	-292	-1%
Sweden	-62 263	-32 551	-33 315	14.9%	28 947	46%	-765	-2%
EU-27	**-324 436**	**-204 265**	**-223 878**	**100%**	**100 558**	**31%**	**-19 613**	**-10%**

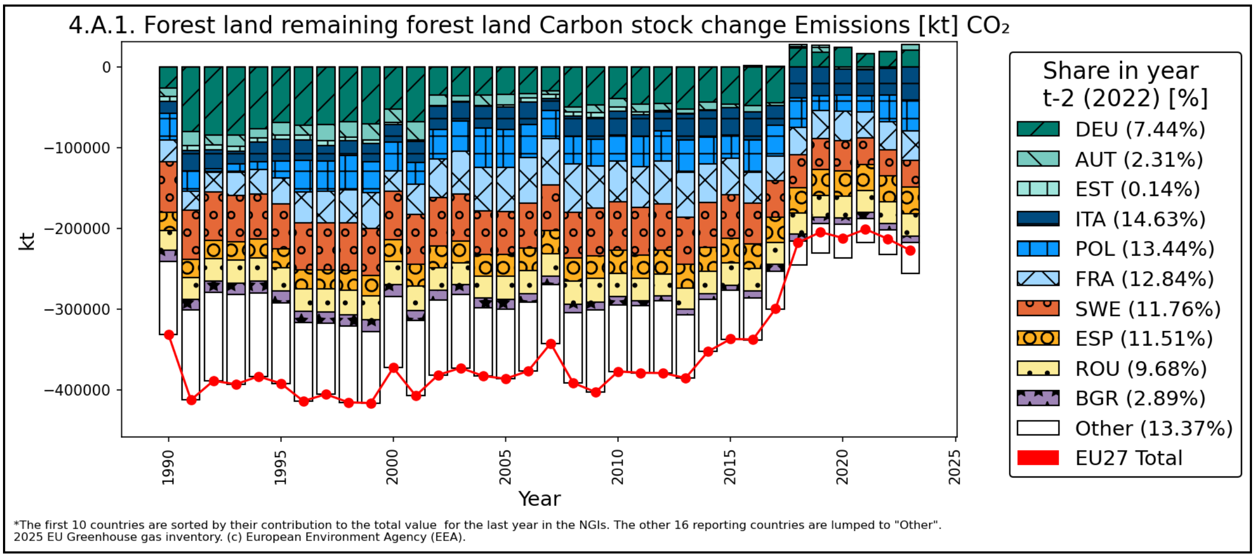
Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

For the year 2023, apart from Austria, Estonia, Germany, Ireland, Latvia and Malta, individual submissions report a net sink under Forest Land remaining Forest Land.

Important changes in terms of reported amounts, as compared with 1990, are both due to the increase in harvesting rates, but also, the impact of natural disturbances in forest, which result in significant salvage logging practices. Also, higher temperatures lead to loss of previously stored carbon due to faster decay rates and less net increment likely also linked to drought and negative impacts on forest health. Three Member States, Germany, Finland and Sweden all report significant fewer net removals in 2023 compared to 19900, while Italy, France and Spain all report significant more net removals when comparing 2023 with 1990. Comparing 2023 with 2022 shows also large changes including for Austria, Germany and Estonia that all have net emissions in 2023 and for Italy, Poland and Czechia that all have significantly more net removals in 2023 compared to 2022.

The 5 MS with the largest contribution to the total net carbon sink in 2023 are Italy, Poland, France, Sweden and Spain (Figure 6.4).

Figure 6.4 Trend of emissions (+)/removals (-) in subcategory 4A1 "Forest land remaining Forest Land" in EU (kt CO_2)



Inter-annual variations in this subcategory are closely related to natural disturbances. In this respect, wildfires, in southern European countries, and windstorms and insect infestations, in several central European countries, resulted in a significant source of GHG emissions directly emitted to the atmosphere, or lagged emissions, via the transfer of carbon to other pools that are reflected in the trend at EU level.

Portugal and Italy report for the year 2017 enormous areas of forests and grasslands affected by wildfires. The impact of these events is about 25.000 kt CO_{2eq} emitted to the atmosphere. Noteworthy is also the significant impact that Germany reports from the massive storm "Vivian" that caused an estimated loss, due to windfalls, of about 70 Mm^3 of wood in 1990.

The emissions of CO_2 from biomass burning are, in many cases, implicitly reported in CRT table 4.A, as part of the "stock-change" approach used to report carbon stock changes, while related non-CO_2 emissions are reported in CRT table 4(IV).

Estimation of emissions from forest fires is made with default methods in case of small emissions or with higher Tiers, involving country-specific information, where such emissions have a significant share within the overall carbon budget of the country.

In general, emissions from natural disturbances that do not necessarily result in instantaneous carbon oxidation (e.g., insect outbreaks) are not easy to quantify as an annual biomass loss, and therefore they are practically not explicitly mentioned in the individual national inventory reports but reflected in the long-term estimation through the national forest inventories with an impact that last several years..

This can be seen from Germany that based on new inventory data has reported a significant shift from a sink to a source for their forest for the period 2018-2023 due to an unprecedented drought and a bark-beetle outbreak experienced in its forests.

Among individual inventories with the largest inter-annual variability in GHG estimates that affect the EU trend of this category are:

- Forest fires (e.g., Portugal in 1990, 2003, 2005 and 2017; Italy in 1990, 1993, 2007, 2017 and 2021; Greece 2007; Spain 2022; France 2003 and 2022).
- Windstorms (e.g., Germany 1990, France in 1999 and 2009, and Denmark in 2000, Sweden in 2005, Italy in 2018).
- Drought followed by bark beetle infestation (Czechia 2018-2022 and Germany 2018-2023).

Methodological issues for Forest Land remaining Forest Land category

The definition of forest land is reported by all individual submissions (Table 6.3; Table 6.4). The consistency of these definitions with the land representation system is ensured within the national inventory systems in terms of time and space. The forest definitions among countries slightly differ in terms of the quantitative parameters (i.e., crown cover, tree height and minimum area) used to define a land as forest.

In general, these forest definitions are consistent with definitions used by countries under other international reporting frameworks (e.g., Global Forest Resources Assessments FRA (FAO)). For forest administrative purposes, forest lands without tree coverage may be included or not in the forest area, and thus, additional qualitative criteria complement the forest definition. As an example, the definitions may include a reference to forest roads, un-stocked forest areas, nurseries, willow crops, etc.

Few countries have changed their forest definition since 1990, but recalculations of the entire time-series ensured the consistency on activity data. The overall effect of different forest definitions on carbon stock changes at EU level is difficult to assess because it depends on several factors (e.g., land fragmentation, land use change frequency, transition period, land registry systems, GHG estimation methodology, etc.), but is considered small. Ultimately the implementation of country-specific forest definitions contributes to ensure that the large variety of forest ecosystems, and their management practices, that are in Europe are all considered in the GHG inventories.

National forest inventories provide fundamental data inputs for both the estimation of areas, and the estimation of forest carbon stocks, and their changes. In very few cases, this information is also taken, or complemented, from data from forest management plan databases (especially when countries experience difficulties getting information for the first years of the time series).

Data collection approach of national forest inventories is typically based on repeated measurements of parameters on permanent sampling plots, but the sampling design differs among MS in terms of sample size, and frequency of the field surveys.

Given that the availability of annual data is barely available for this sector. Partly because it is not cost-efficient to increase the sampling frequency of some parameters since some changes are not captured on an annual basis. Countries have devoted efforts to meeting reporting requirements and to ensure the consistency of the time series. Annual values are usually obtained by interpolation and extrapolation of available data sets. The main data source for forest areas, the national forest inventories, are in many instances complemented with auxiliary information in the form of national statistics (i.e. surveys) or remotely sensed products (i.e. satellite images, aerial photographs).

In this sense, not only for forests, but with a wider focus on acquiring data to monitoring lands and information for a better management, the result of some EU programs is already used by countries to improve their LULUCF reporting information (e.g., Copernicus products or Corine Land Cover data)

Furthermore, countries usually have disaggregated forest areas in various subdivisions according to available datasets. The breakdown criteria differ across countries, although they are consistent across time series. The aim is to differentiate and stratify the forest to capture the impact that specific strata features have on the GHG estimates. Main strata are based on forest types (e.g. broadleaved/coniferous; evergreen/deciduous; species based classification – beech, oak, pine, spruce, etc.); climate conditions (e.g. temperate moist or temperate dry,); soil and site type (e.g. lowlands, mountains), administrative or geographical boundaries (e.g. northern, southern territories), and management type (e.g. coppice, high forest).

For instance, forest inventories define above-ground biomass carbon pool according to the threshold of minimal diameter of the vegetation that is measured (i.e. DBH– diameter at breast height) up to 7,5 cm. Concerning the below-ground biomass, the information on what exactly is included on this carbon pool is sparse. Dead wood mostly differs in terms of decay time and thresholds of diameters and height/length of wood pieces included in the pool. Litter is either independently assessed or included with soils. In soil organic carbon, carbon stock changes are computed according to various methods and transition periods. Usually, carbon stock in understory biomass is only accounted in principle for estimating forest fires emissions.

Table 6.11 IPCC Method used for estimating carbon stock changes in forest aboveground biomass.

Country	IPCC method
Austria	*Gain-loss*
Belgium	*Stock-difference*
Bulgaria	*Stock-difference*
Croatia	*Gain-loss*
Cyprus	*Gain-loss*
Czechia	*Gain-loss*
Denmark	*Stock-difference*
Estonia	*Gain-loss*
Finland	*Gain-loss*
France	*Gain-loss*
Germany	*Stock-difference*
Greece	*Stock-difference*
Hungary	*Stock-difference*
Ireland	*Gain-loss*
Italy	*Gain-loss*
Latvia	*Gain-loss*
Lithuania	*Stock-difference*
Luxemburg	*Gain-loss*
Malta	*Gain-loss*
Netherlands	*Gain-loss*
Poland	*Stock-difference*
Portugal	*Gain-loss*
Romania	*Gain-loss*
Slovakia	*Gain-loss*
Slovenia	*Stock-difference*
Spain	*Stock-difference*
Sweden	*Stock-difference*

Data sources for the estimation of carbon stock changes in living biomass also differ among countries, upon data availability. Nowadays, NFIs represent the primary source of information for most of MS, while others rely on other forestry statistics and yield tables. In addition, forest fire statistics complement both data sources. Data collection and data analysis programs are ongoing in most countries to further improve the completeness and accuracy of the estimates, primarily of carbon stock changes.

When they are estimated, countries mainly rely on data collected in the course of the national forest inventories. However, it should be noted that the widespread use of the tier 1 assumption is due to the lack of appropriate data, and the high costs associated with systems that would allow a proper collection of this information, in other cases also to the very high uncertainty of the existing data.

Nevertheless, an increasing number of countries document ongoing efforts to estimate emissions and removals from dead organic matter and mineral soils in forest. This has resulted in more countries reporting for the first time carbon stock changes in these pools using country-specific data.

When data on soil organic carbon content is available from two measurement cycles, they are often directly used for estimating carbon stock changes using stock difference approaches. In a few cases, data is also integrated in models. Moreover, depending on the availability of datasets in individual countries, carbon stock changes in dead organic matter are often disaggregated between dead wood and litter or some countries include their estimates within soil organic carbon pool.

Carbon stock changes in mineral soils under forest land remaining forest land in this submission are quantitatively estimated generally as a small net sink of carbon.

Most of the countries report absence or insignificant areas of organic soils under this land use subcategory. However, when organic soils are present, they are reported in most cases as a net source of emissions.

6.4.2.3 Land converted to Forest Land (CRT 4.A2)

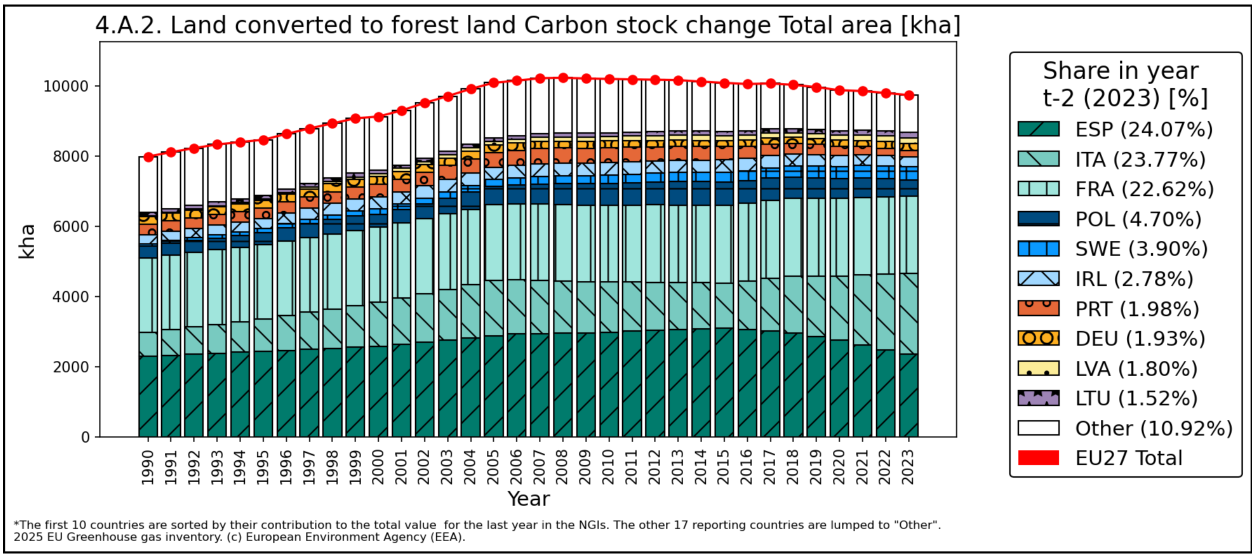
Overview of Land converted to Forest Land category

In this submission, the area reported under this subcategory represents 6% of the total Forest Land area. (Figure 6.5).

Most of the new forest lands are converted from Grassland and Cropland areas, and although within the overall forest land category they have a low share in terms of areas, they contribute by 20% to the total carbon sink of the European forests. This high percentage both illustrates the stronger growth of younger stands that in most cases are not yet subject to harvesting but also that many older stands with taller trees and more biomass per hectare tend to be more impacted by natural disturbances.

In term of areas, Spain, Italy and France together contribute with about 70% of the total areas being converted to forest land.

Figure 6.5 Trend of activity data in subcategory 4A2 "Land converted to Forest Land" in EU (kha)



This subcategory has been always reported as a net carbon sink at the EU level. In this submission, it reaches -57 411 kt CO_2, which represents an increase of the sink by 5% as compared with 1990. (Figure 6.6; Table 6.12).

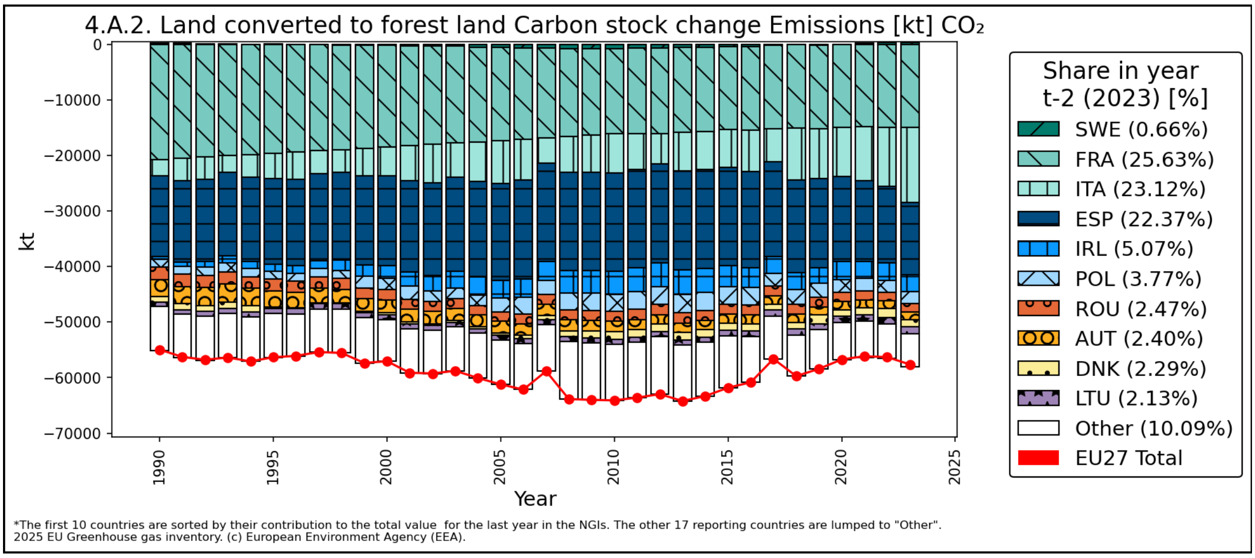
Table 6.12 4A2 Land converted to Forest Land: EU contributions to net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	-2 959	-1 423	-1 402	2.4%	1 557	53%	21	1%
Belgium	1	-637	-657	1.1%	-658	-89333%	-20	-3%
Bulgaria	-2 775	-190	-80	0.1%	2 695	97%	110	58%
Croatia	-29	-241	-260	0.5%	-231	-801%	-19	-8%
Cyprus	0	-18	-19	0.0%	-19	-19738%	-1	-5%
Czechia	-220	-524	-526	0.9%	-305	-139%	-2	0%
Denmark	-1 022	-1 605	-1 335	2.3%	-313	-31%	270	17%
Estonia	-8	-250	-233	0.4%	-225	-2778%	16	7%
Finland	-59	-149	-142	0.2%	-83	-140%	7	5%
France	-20 815	-14 921	-14 971	26.1%	5 844	28%	-50	0%
Germany	107	-622	-597	1.0%	-704	-659%	25	4%
Greece	NE,NO	-41	-20	0.0%	-20	-∞	21	51%
Hungary	-394	-1 063	-1 034	1.8%	-640	-162%	29	3%
Ireland	-522	-3 138	-2 955	5.1%	-2 433	-466%	182	6%
Italy	-2 849	-10 654	-13 504	23.5%	-10 655	-374%	-2 850	-27%
Latvia	-10	-248	-258	0.5%	-248	-2485%	-10	-4%
Lithuania	-703	-1 107	-1 127	2.0%	-425	-60%	-21	-2%
Luxembourg	-43	-11	-10	0.0%	33	77%	1	12%
Malta	NO	0	0	0.0%	0	-∞	0	-4%
Netherlands	-841	-703	-703	1.2%	137	16%	0	0%
Poland	-1 376	-2 080	-2 202	3.8%	-827	-60%	-122	-6%
Portugal	-1 197	-1 049	-923	1.6%	274	23%	126	12%
Romania	-2 291	-1 520	-1 444	2.5%	847	37%	75	5%
Slovakia	-2 263	-339	-338	0.6%	1 925	85%	1	0%
Slovenia	-233	-78	-76	0.1%	157	67%	2	2%
Spain	-14 165	-13 535	-12 977	22.6%	1 188	8%	558	4%
Sweden	184	274	385	-0.7%	202	110%	111	40%
EU-27	**-54 483**	**-55 872**	**-57 411**	**100%**	**-2 928**	**-5%**	**-1 539**	**-3%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

As shown in Table 6.12, some MS reported significant changes in this subcategory as compared with 1990, for instance, Italy and Ireland with more net removals and France, Bulgaria and Slovakia with less net removals. Sweden is the only Member State that reports net emissions from afforestation. This is due to emissions from organic soil being converted to forest land.

Figure 6.6 Trend of emissions (+)/removals (-) in subcategory 4A2 “Land converted to Forest Land” in EU (kt CO_2)



For this year, about 71% of total carbon sink reported in the subcategory 4A.2 was reported by France, Italy and Spain while the 10 MS with the larger contribution represent about the 90% of the total sink of the new forest areas.

Methodological issues for Land converted to Forest Land category

Methods used to identify and represent the areas converted to forests, as well as to report the associated GHG emissions and CO_2 removals from these areas, are generally the same as the ones used for subcategory 4.A1. Nevertheless, different parameters are involved under each subcategory due to differences among others in growth rates and management practices of these young forests.

Most countries use the default of 20 years for land converted to forest before it is reported under Forest land remaining forest land but a few countries in the northern part of Europe use a 30-year period before land converted to forest land is transferred to Forest land remaining forest land

Most of the countries have developed land identification systems that are able to identify and track land use conversions to, and from, forests. Mainly, as already mentioned, these methods are based on information collected by the national forest inventories on systematic sampling grids, and that, in many cases, is complemented by auxiliary information on the form of satellites images, remote sensing analysis, aerial photography, or national registries.

Estimates of GHG emissions and CO_2 removals from this subcategory are usually reported using tier 2 methods involving country-specific data collected during the national forest inventory. Under this subcategory, living biomass and dead organic matter carbon pools are in most cases reported as a net carbon sink. Mineral soils are reported either as a net source or a net sink of emissions depending on whether there is presence or absence of disturbed soil on new forest areas (i.e., natural regeneration or, soils management practices that enhance carbon oxidation).

Concerning organic soils, countries have reported this carbon pool as a net source of emissions whenever new forest areas were established in this type of soil.

Nevertheless, it should be noted that the heterogeneity in approaches used by the countries under 4A2 suggests caution in interpreting differences in the implied carbon stock change factors among carbon pools. For instance, possible reasons for differences may include the length of the time series on activity data and their starting point, the use of time-averaged annual biomass growth, or the quantity of CO_2 emissions estimated from the land that is converted to forests, including lagged emissions.

6.4.3 Cropland (CRT 4B)

6.4.3.1 Overview of the Cropland category

Subject to intensive agriculture practices, the Cropland category is an important contributor to the EU GHG budget. This category, which includes arable lands for annual crops, permanent crops, set aside lands and rice-fields.

Based on individual submissions reported this year, Cropland areas covered in 2023 a total of 120 809 kha, which represent 29% of the lands reported by EU MS. However, the category shows a steady decreasing trend. For this inventory year the area is about 9% less than in the year 1990,

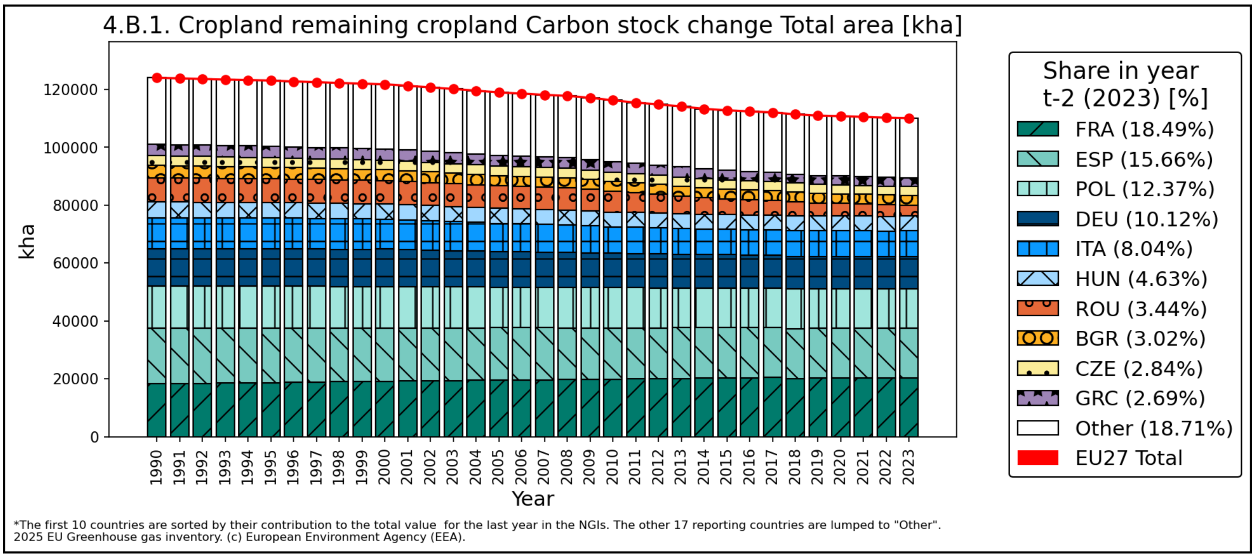
6.4.3.2 Cropland remaining Cropland (CRT 4B1)

Overview of Cropland remaining Cropland category

In line with the overall category, this subcategory has constantly decreased since 1990 (Figure 6.7).

The overall trend of this subcategory is driven by 10 MS which together contribute to about 82% of the total area, and more specifically, France, Spain, Poland, and Germany which represent more than half of the area reported under this subcategory.

Figure 6.7 Trend of activity data in subcategory 4B1 "Cropland remaining Cropland" in EU (kha)



In terms of emissions, at the EU level this subcategory has been always reported as a net source of GHG emissions.

For the year 2023, based on individual submissions, GHG emissions from Cropland remaining Cropland reached 13 393 kt CO_2 which represents a decrease of 60% as compared to 1990 (Table 6.13).

This trend is mainly driven by Denmark, Garmany and Spain that report fewer net emissions in 2023 compared to 1990. At the same time some Member States, Finland, Poland and Slovakia report more emissions in 2023 compared to 1990 (Table 6.13). In general, emissions are the result of the oxidation of soil organic matter, which are particularly important in those MS with presence of cultivated areas on organic soils.

Nevertheless, some MS report a considerable carbon sink in Cropland remaining Cropland. For instance, Spain, Romania and Poland report a substantial net carbon sink in mineral soils and, in some cases, also in the living biomass carbon pool. This is generally justified by the implementation of IPCC methodologies (i.e. tier 1 and tier 2) that result in a net sink when current management practices of soils add more organic matter to the soil than those implemented 20 years before. In addition, net carbon sinks may occur in countries with significant areas of woody crops (i.e., orchards, vineyards, Christmas trees, fruits, bushes, and olive trees) that provide a net sink resulting from carbon accumulation in the living biomass pool.

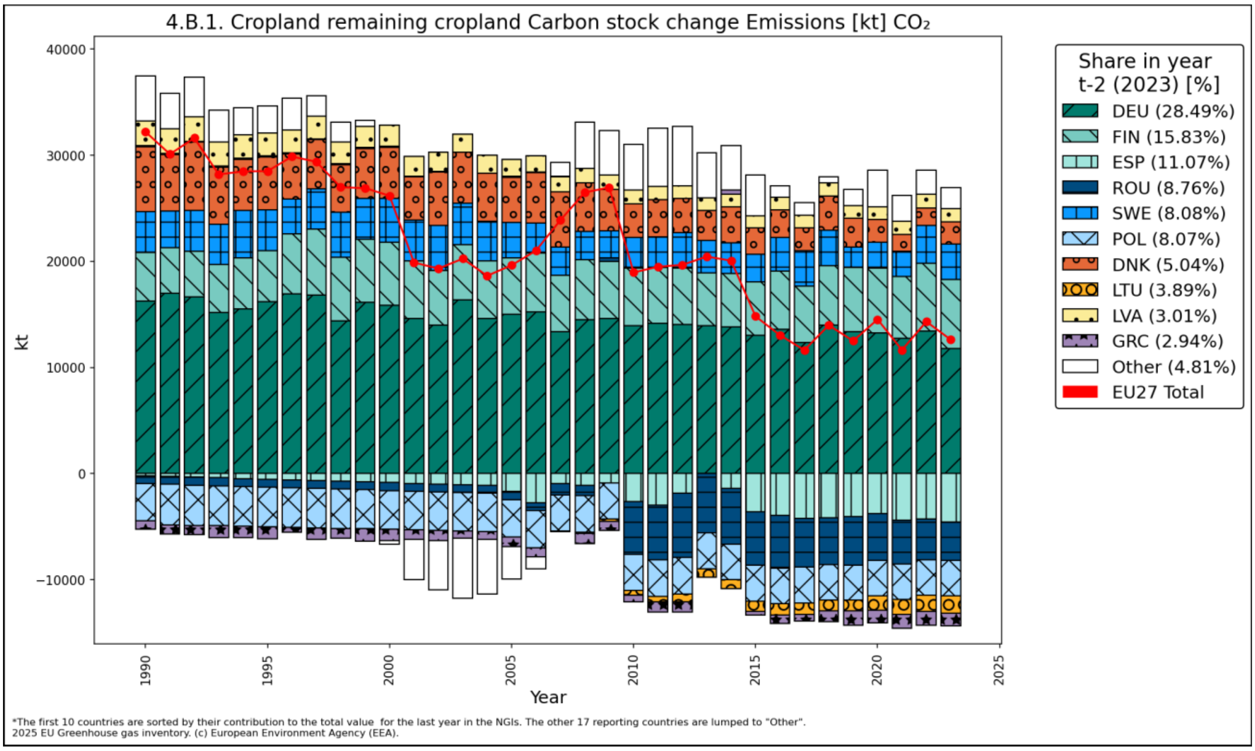
Table 6.13 4B1 Cropland remaining Cropland: EU-27 contributions to net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	201	305	256	1.9%	55	27%	-49	-16%
Belgium	483	339	360	2.7%	-124	-26%	21	6%
Bulgaria	235	200	267	2.0%	31	13%	67	34%
Croatia	89	141	139	1.0%	50	56%	-2	-2%
Cyprus	-134	-134	-133	-1.0%	1	1%	0	0%
Czechia	-13	-17	-22	-0.2%	-9	-73%	-5	-30%
Denmark	6 289	1 719	2 156	16.1%	-4 133	-66%	437	25%
Estonia	646	723	698	5.2%	52	8%	-25	-3%
Finland	4 582	6 373	6 540	48.8%	1 958	43%	167	3%
France	1 538	618	611	4.6%	-927	-60%	-7	-1%
Germany	16 240	13 417	11 771	87.9%	-4 468	-28%	-1 646	-12%
Greece	-819	-1 299	-1 216	-9.1%	-398	-49%	83	6%
Hungary	40	-24	-10	-0.1%	-50	-126%	14	57%
Ireland	-48	-83	82	0.6%	130	269%	165	198%
Italy	1 272	1 253	621	4.6%	-652	-51%	-632	-50%
Latvia	2 364	1 253	1 242	9.3%	-1 121	-47%	-11	-1%
Lithuania	201	-1 412	-1 502	-11.2%	-1 703	-848%	-90	-6%
Luxembourg	0	-76	-76	-0.6%	-76	-40157%	0	0%
Malta	0	-1	-1	0.0%	-1	-1395%	0	0%
Netherlands	1 418	658	800	6.0%	-618	-44%	141	21%
Poland	-3 490	-3 323	-3 335	-24.9%	155	4%	-12	0%
Portugal	385	-456	-541	-4.0%	-926	-241%	-85	-19%
Romania	-577	-3 701	-3 449	-25.8%	-2 873	-498%	252	7%
Slovakia	-951	-690	-689	-5.1%	262	28%	1	0%
Slovenia	50	62	60	0.5%	11	21%	-2	-3%
Spain	-207	-4 250	-4 574	-34.2%	-4 368	-2112%	-325	-8%
Sweden	3 874	3 605	3 338	24.9%	-536	-14%	-266	-7%
EU-27	**33 670**	**15 201**	**13 393**	**100%**	**-20 277**	**-60%**	**-1 809**	**-12%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 6.8 Trend of emissions (+)/removals (-) in subcategory 4B1 "Cropland remaining Cropland" in EU (kt CO_2)



Methodological issues for Cropland remaining Cropland category

Lands included under this category generally are in line with the IPCC definition (Table 6.5). However, there could be national particularities (e.g., treatment of some woody crops) that result in small differences among countries.

In some cases, because of the absence of annual information on activity data, coupled with the fact that management practices include crops-rotation cycles and fallow lands, some cropland areas may not be clearly separated from grassland areas. In these cases, countries have defined the number of years before a land is shifted from/to cropland and grassland.

Overall, following the IPCC approach, the carbon pool living biomass is assumed in balance for annual crops, while carbon stock changes are reported for conversions among annual and woody crops. Concerning carbon stock changes in woody crops, countries often implement the IPCC approach, either by using country-specific data on biomass accumulation from growth and maturity cycles, or by using default data. Carbon stock changes in dead organic matter are in most cases reported following the IPCC assumption that the dead organic matter stocks are not present in croplands, or they are in equilibrium. In some cases, however, some MS have reported this pool as a net sink or as a net source.

With regard to carbon stock changes in soils, these have been reported under mineral soils as either a net source or a net sink of carbon. The final net result is typically associated with an increase or decrease of the intensity in the soil management practices along the time series. By contrary, as reported by all countries, for cultivated organic soils the net result of carbon stock changes is associated with a source of CO_2 emissions. Methodologies for reporting this carbon pool follow, in most of the cases, IPCC tier 1 or tier 2 approaches, where carbon stock changes are estimated as the difference on the carbon stock in soils at two moments in time. In a some cases, carbon stock changes have been estimated by using models.

Applied tier 2 methods rely often on the use of country-specific soil organic carbon reference values along with IPCC default values for relative change factors (i.e., for Fmg, Flu, Fi). In some cases, IPCC default relative change factors have been slightly modified to adapt them to national circumstances, but changes rely more on expert judgment than on a statistical analysis or systematic measurements. Parameters to estimate carbon stock change for living biomass of permanent crops vary depending on the types of crops and management practices across Europe, from North (i.e., bush-type currant crops) to South (i.e., olives trees and agroforestry systems).

6.4.3.3 Land converted to Cropland (CRT 4B2)

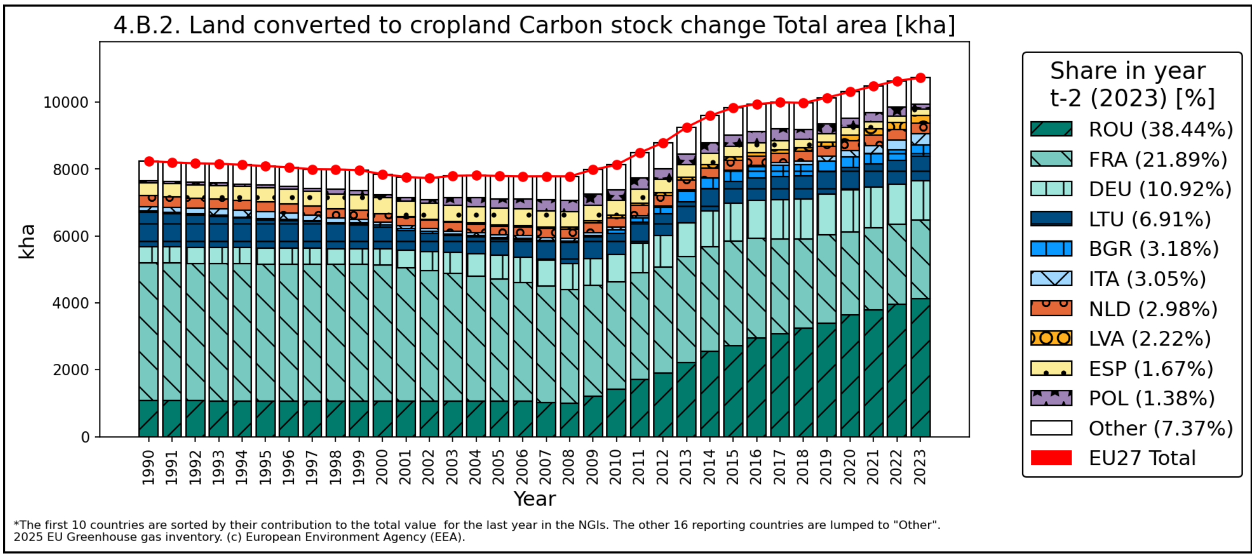
Overview of Land converted to Cropland category.

In terms of area, this subcategory represents 9% of the total cropland areas reported at the level of EU MS. However, it accounts for 58% of the net CO_2 emissions that are reported in Cropland.

In overall, for this inventory year the area increased by 30% as compared with 1990 (Figure 6.9).

Main conversions of lands to Cropland take place from areas of Grassland and Forest land. The trend in this subcategory is mainly driven by Romania, France and Germany, which report more than 60% of total area of new Croplands, often associated with rotation of crops and grasses on the same land.

Figure 6.9 Trend of activity data in subcategory 4B2 "Land converted to Cropland" in EU (kha)



In terms of emissions, this subcategory is reported as a net source of emissions that for the current inventory year reaches 18 406 Kt CO_2. This represents a decrease of 51% as compared to 1990 (Table 6.14 6.13). The largest emissions are reported by France, which reports about 61 % of the total emissions in this subcategory; followed by Germany with 40%.

Only Member State, Romania reports this subcategory as a carbon sink, because of removals from the living biomass carbon and the soil carbon pool when lands are converted to Croplands.

Table 6.14 4B2 Land converted to Cropland: EU contributions to net CO_2 emissions (+)/ removals (-) (CRT table 4)

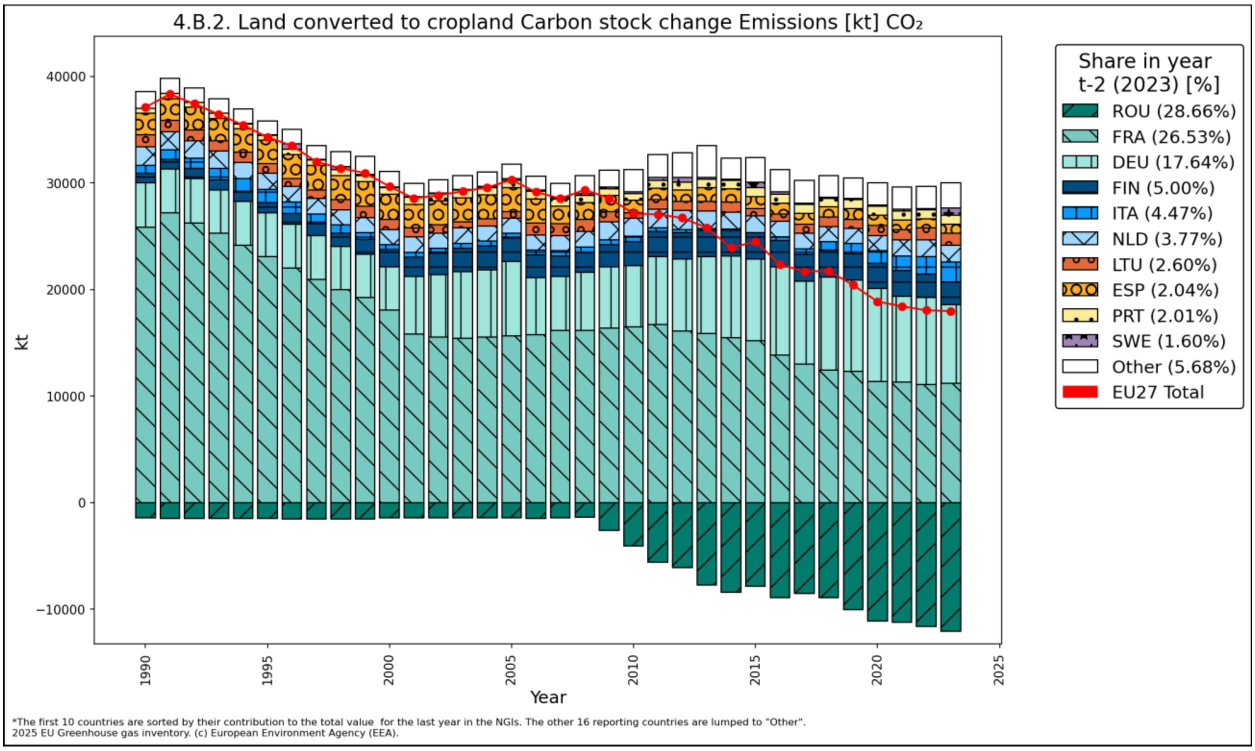
Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	173	170	172	0.9%	-1	-1%	2	1%
Belgium	42	506	514	2.8%	472	1115%	7	1%
Bulgaria	49	407	609	3.3%	560	1153%	202	50%
Croatia	26	120	116	0.6%	91	350%	-4	-3%
Cyprus	0	6	6	0.0%	6	2374%	0	-1%
Czechia	119	52	55	0.3%	-64	-54%	3	6%
Denmark	63	-14	66	0.4%	3	4%	80	568%
Estonia	NE,NO	139	141	0.8%	141	∞	3	2%
Finland	918	2 229	2 107	11.4%	1 188	129%	-122	-5%
France	25 858	11 064	11 169	60.7%	-14 689	-57%	106	1%
Germany	4 142	8 164	7 425	40.3%	3 283	79%	-740	-9%
Greece	52	20	17	0.1%	-36	-68%	-3	-16%
Hungary	27	143	149	0.8%	122	454%	6	4%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	749	1 642	1 884	10.2%	1 135	152%	242	15%
Latvia	-12	354	354	1.9%	366	3067%	0	0%
Lithuania	1 435	1 508	1 534	8.3%	99	7%	25	2%
Luxembourg	78	1	0	0.0%	-78	-100%	-1	-72%
Malta	-2	-1	-1	0.0%	1	56%	0	17%
Netherlands	1 747	1 537	1 588	8.6%	-159	-9%	51	3%
Poland	272	94	94	0.5%	-178	-65%	0	0%
Portugal	466	846	845	4.6%	380	82%	-1	0%
Romania	-1 454	-11 642	-12 066	-65.6%	-10 612	-730%	-424	-4%
Slovakia	467	41	35	0.2%	-431	-92%	-6	-14%
Slovenia	197	61	62	0.3%	-135	-68%	1	2%
Spain	2 037	898	858	4.7%	-1 179	-58%	-40	-4%
Sweden	-4	83	672	3.6%	675	18113%	589	713%
EU-27	**37 446**	**18 428**	**18 406**	**100%**	**-19 040**	**-51%**	**-22**	**0%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

Abbreviations are explained in the Chapter 'Units and abbreviations'.

As in other land use subcategories that involve the conversion of areas, the trends in the time series of emissions from Land converted to Cropland have been driven by the activity data.

Figure 6.10 Trend of emissions (+)/ removals (-) in subcategory 4B2 “Land converted to Cropland” in EU (kt CO_2)



Methodological issues for Land converted to Cropland.

For estimating and reporting carbon stock changes in this subcategory, the countries generally use the IPCC default methodology. However, implementation of country-specific or default emissions factors depends on which type of lands is being converted to Cropland, and the estimated carbon pool.

Usually, it is assumed that the carbon stored in living biomass and dead organic matter is lost in the year of the conversion, while for soil organic carbon in mineral soils, following IPCC methodology, countries often apply a 20-year transition period before the carbon stock of the soils converted to cropland reach the equilibrium.

In recent years, improvements have been implemented also in this subcategory, including the use of higher methods (as requested by the ERT), which have resulted in an overall increase of accuracy and completeness of the sector.

6.4.4 Grassland (CRT 4C)

6.4.4.1 Overview of Grassland category (CRT 4C)

Under this category are included lands covered by natural and artificial meadows, range lands, moors and forage crops. They can be subject to economic activities (e.g., grazing lands), or be considered unmanaged lands. In several instances, Grassland areas cover also woody lands (i.e., trees and shrub lands) when they do not fall into the thresholds used to define forest lands.

In overall, Grassland is reported as net source of emissions.

Based on individual submissions, for the current inventory year total Grassland covers 70 917 kha. This represents 17% of the total territory of EU. However, as for Cropland, these areas have constantly decreased, and nowadays these ecosystems cover 8% less area than in the base year.

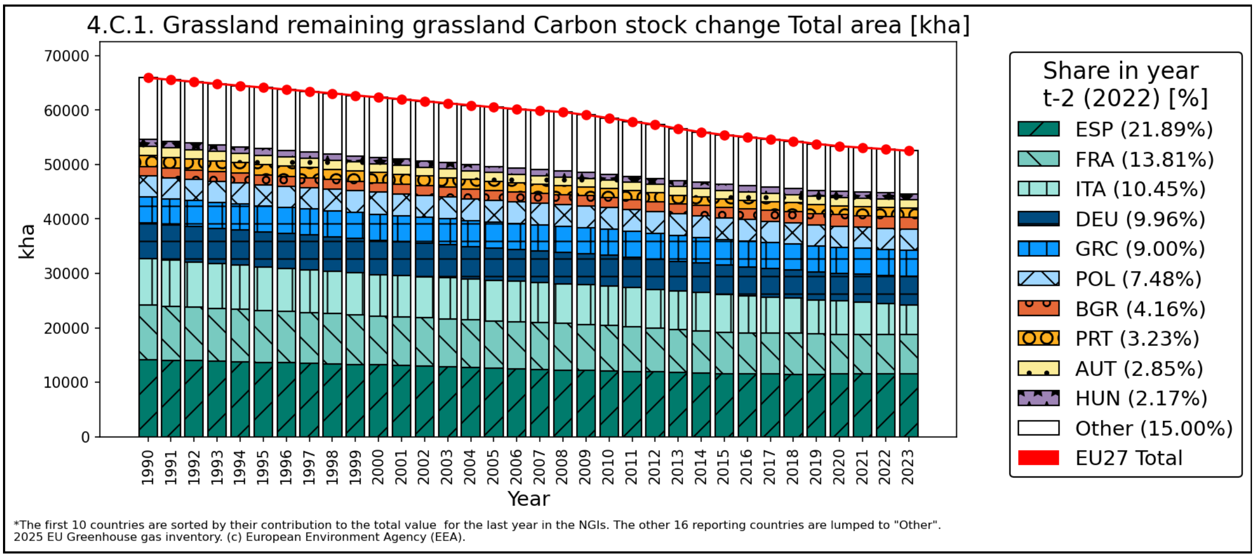
6.4.4.2 Grassland remaining Grassland (CRT 4.C1)

Overview of Grassland remaining Grassland category

Following the general trend of these lands, this subcategory has also constantly decreased since 1990, and in 2023 (Figure 6.11).

Spain, France and Italy report together about 46% of the total area of Grassland remaining Grassland, while the 10 MS with the larger contribution account for about 85% of the total area.

Figure 6.11 Trend of activity data in subcategory 4C1 "Grassland remaining Grassland" in EU (kha)



In terms of emissions, this subcategory has always resulted in a net source at the level of EU. In the current inventory year, the reported emissions reached 25 190 kt CO_2, which represents a decrease of 44% as compared with the year 1990 (Table 6.15).

Nevertheless, individual inventories have reported this subcategory either as a net source or as a net sink of carbon.

As in the case of cropland areas, the net result of the carbon stock change in grassland depends on the one hand on whether these areas are subject to agricultural activities, and particularly if they occur in organic soil areas, but also on the presence or absence of significant woody biomass and the intensity and variation of management practices over the years.

Table 6.15 4C1 Grassland remaining Grassland: EU contributions to net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	371	371	371	1.5%	0	0%	0	0%
Belgium	-133	108	109	0.4%	242	181%	1	1%
Bulgaria	115	78	77	0.3%	-37	-32%	-1	-1%
Croatia	2	2	2	0.0%	0	0%	0	0%
Cyprus	-23	-22	-22	-0.1%	2	8%	0	0%
Czechia	0	-370	-400	-1.6%	-400	-100%	-31	-8%
Denmark	511	731	719	2.9%	208	41%	-12	-2%
Estonia	-119	-96	-96	-0.4%	23	20%	0	0%
Finland	785	508	525	2.1%	-260	-33%	17	3%
France	-1 072	-740	-651	-2.6%	421	39%	89	12%
Germany	30 462	30 250	24 787	98.4%	-5 675	-19%	-5 464	-18%
Greece	0	0	0	0.0%	0	54%	0	7186750%
Hungary	25	-122	-95	-0.4%	-121	-476%	27	22%
Ireland	2 258	1 105	1 079	4.3%	-1 179	-52%	-26	-2%
Italy	5 432	590	-2 610	-10.4%	-8 042	-148%	-3 200	-542%
Latvia	935	490	499	2.0%	-436	-47%	9	2%
Lithuania	1 578	1 535	1 499	6.0%	-79	-5%	-36	-2%
Luxembourg	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Malta	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Netherlands	2 423	1 961	2 183	8.7%	-240	-10%	222	11%
Poland	1 266	643	628	2.5%	-637	-50%	-15	-2%
Portugal	944	-1 066	-1 485	-5.9%	-2 429	-257%	-419	-39%
Romania	-348	-1 038	-710	-2.8%	-362	-104%	328	32%
Slovakia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Slovenia	235	-337	-320	-1.3%	-555	-236%	16	5%
Spain	-8	-34	-34	-0.1%	-26	-348%	1	2%
Sweden	-771	-897	-866	-3.4%	-95	-12%	31	3%
EU-27	**44 867**	**33 652**	**25 190**	**100%**	**-19 677**	**-44%**	**-8 463**	**-25%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

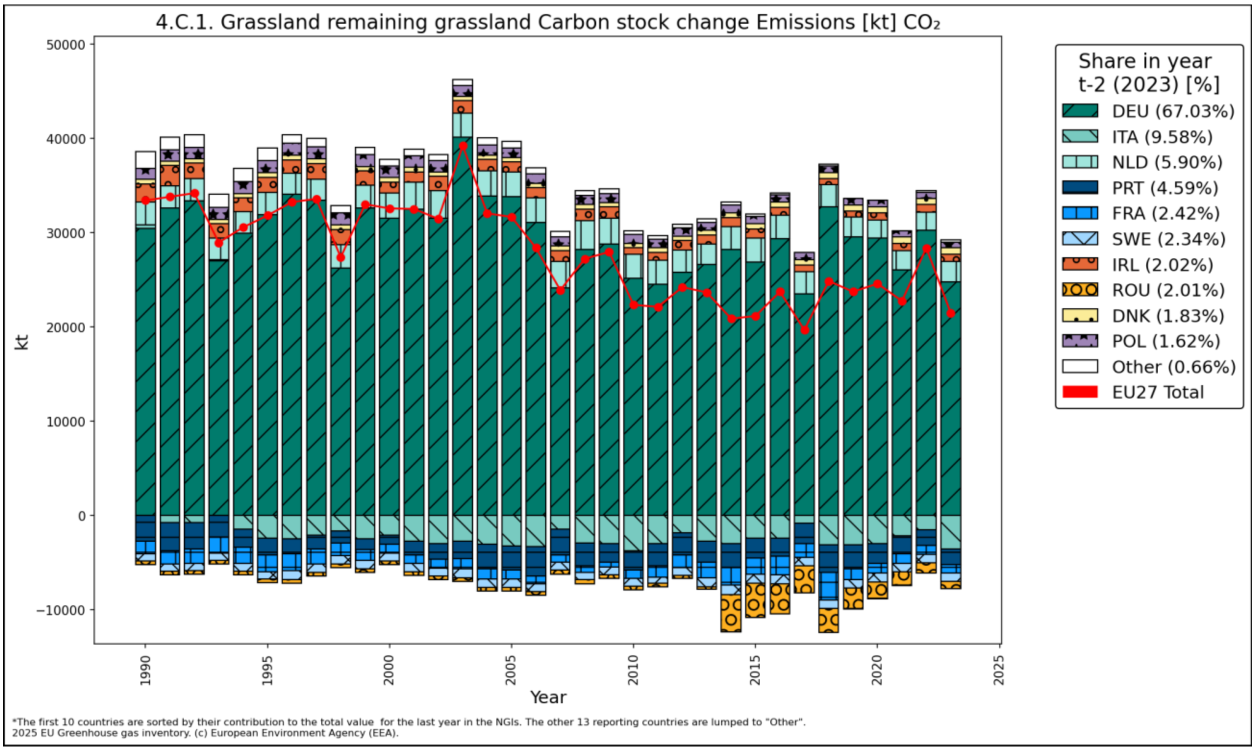
Abbreviations are explained in the Chapter 'Units and abbreviations'.

The EU trend in net emissions from this subcategory is largely affected by Italy, Germany and Portugal (Figure 6.12).

While some MS report a sink such as Italy and Portugal due to increasing carbon stocks in living biomass while other MS report this subcategory as a source of CO_2 emissions mostly due to the occurrence of organic soils.

In Mediterranean countries, this subcategory shows significant inter-annual variability driven by wildfires affecting woody biomass in grassland areas. These episodes, at present occurring erratically, are expected to increase because of the climate change.

Figure 6.12 Trend of emissions (+)/removals (-) in subcategory 4C1 "Grassland remaining Grassland" in EU (kt CO_2)



Methodological issues for Grassland remaining Grassland category

Despite different eco-regions and management approaches among the countries, Grassland definitions show a good match with the IPCC land use definition (Table 6.6). One of the most significant differences that should be considered when comparing implied emissions factors is the presence or absence of reported unmanaged grassland and the presence or absence of woody vegetation.

In general, there is a wide-spread use of the Tier 1 method for reporting carbon stock changes in living biomass and dead organic matter, which assumes no net carbon stock changes for these pools. However, some countries have developed country-specific data and (or) methodologies to assess the changes in these pools (e.g., Italy, Latvia, and Sweden). When this is the case, these pools are generally reported as a net sink that is associated with the presence of woody biomass on grassland areas.

Under mineral soils, a significant number of individual submissions have demonstrated that there are no changes over the time in the type of management practices that impact the carbon storage in the soils. In a few cases also the absence of managed soils was argued. In these cases, quantitative estimates were not provided, and the notation keys were used instead. However, some other countries report this carbon pool using IPCC methodology, with country-specific or default data.

For those countries that report the presence of organic soils areas under managed grassland, this carbon pool is reported as a net source of emissions that result from the oxidation of the soil organic matter (Table 6.15).

6.4.4.3 Land converted to Grassland (CRT 4C2)

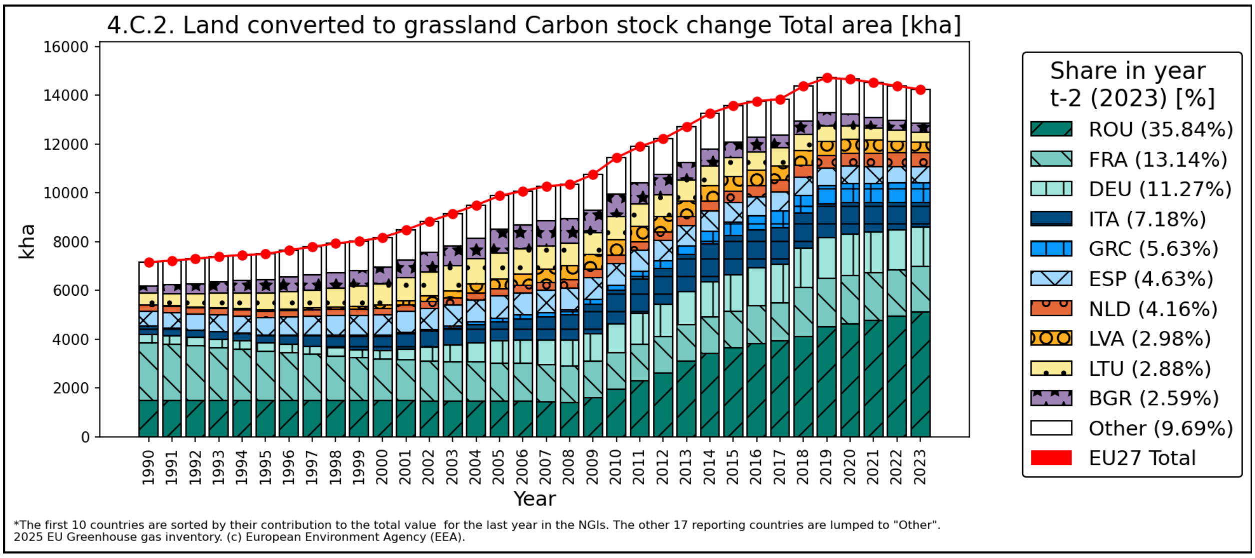
Overview of Land converted to Grassland category.

In terms of area, this subcategory represents 20% of the total grassland areas; however, the carbon sink reported offsets about 66% of the emissions resulting from grassland remaining grassland.

The area reported under this subcategory is about two times the area reported in 1990 under this category (Figure 6.13). Main conversions to grassland areas have origin in former croplands and, to a lesser extent, on forests land.

The main drivers of the EU trend on new grassland areas originate from the reporting of Romania, France and Germany, which together report about 60% of the total area converted to Grassland.

Figure 6.13 Trend of activity data in subcategory 4C2 "Land converted to Grassland" in EU-27 (kha)



In terms of emissions, lands converted to Grassland represent in the current inventory year a total net sink of -16587 kt CO_2, which corresponds to an increase of about 93% compared to the year 1990 (Table 6.16).

The trend in GHG emissions for this subcategory is by far driven by Italy, and followed by Greece and Germany, in all cases, the net sink reported under this category is the result of carbon sequestration in mineral soils. By contrary, final net emissions, as reported for several countries, as for instance Latvia and Sweden, are associated with emissions from the conversion of Forest land, and to a lesser extent, from woody crops to Grassland.

Table 6.16 4C2 Land converted to Grassland: EU contributions to the net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	421	214	222	-1.3%	-199	-47%	8	4%
Belgium	40	-83	-103	0.6%	-142	-358%	-19	-23%
Bulgaria	-917	-857	-586	3.5%	331	36%	270	32%
Croatia	-10	-303	-289	1.7%	-279	-2806%	14	5%
Cyprus	0	2	2	0.0%	2	459%	0	0%
Czechia	-156	-234	-233	1.4%	-78	-50%	0	0%
Denmark	72	30	38	-0.2%	-33	-47%	9	29%
Estonia	0	-86	-79	0.5%	-79	-23466%	7	8%
Finland	270	226	178	-1.1%	-91	-34%	-47	-21%
France	-4 905	-3 884	-3 779	22.8%	1 126	23%	105	3%
Germany	172	-2 246	-2 788	16.8%	-2 961	-1717%	-542	-24%
Greece	0	-2 041	-2 071	12.5%	-2 071	-7383840%	-30	-1%
Hungary	-4	39	29	-0.2%	33	913%	-10	-26%
Ireland	3	9	41	-0.2%	38	1326%	31	334%
Italy	-1 124	-4 335	-3 934	23.7%	-2 809	-250%	402	9%
Latvia	-87	956	904	-5.5%	991	1134%	-52	-5%
Lithuania	-1 499	-1 609	-1 462	8.8%	37	2%	147	9%
Luxembourg	-69	-5	-4	0.0%	65	94%	1	19%
Malta	-11	-3	-3	0.0%	8	73%	0	0%
Netherlands	-690	-772	-854	5.1%	-164	-24%	-82	-11%
Poland	-1 207	-925	-976	5.9%	231	19%	-51	-5%
Portugal	NO	-182	-93	0.6%	-93	-∞	88	49%
Romania	2 189	-629	-756	4.6%	-2 944	-135%	-127	-20%
Slovakia	-196	-36	-28	0.2%	168	86%	8	23%
Slovenia	-490	67	74	-0.4%	564	115%	7	10%
Spain	-788	-901	-1 031	6.2%	-242	-31%	-129	-14%
Sweden	404	161	994	-6.0%	590	146%	832	516%
EU-27	**-8 584**	**-17 426**	**-16 587**	**100%**	**-8 003**	**-93%**	**839**	**5%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

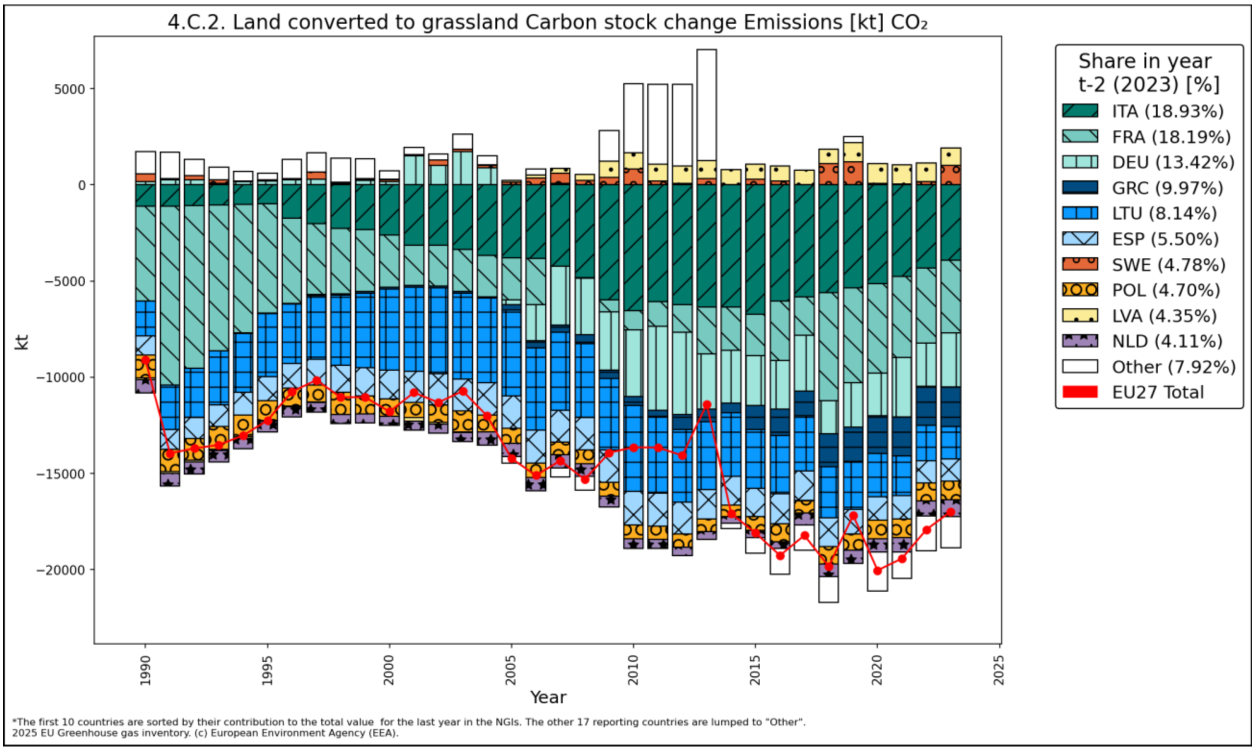
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Major changes in the time series of emissions from Land converted to Grassland have been reported by Romania, Italy and France, mainly driven by the activity data.

New grassland areas are associated with the abandonment of cropland areas that result in a larger carbon sink reported in mineral soils at the end of the time series as compared with the base year. By contrary, some countries report a significant decrease of the carbon sink in these lands driven by the decrease of these areas but also when they are affected by wildfires in specific years.

The EU trend for this category reflects in the year 2013 the impact of the reporting of France that in 2021 has introduced a complete update of the methodology for land use change monitoring and for calculating carbon fluxes using a spatially explicit approach. This new method led to various recalculations, among others the area of deforestation, which is the main driver of the increase in the emissions for that year.

Figure 6.14 Trend of emissions (+)/removals (-) in subcategory 4C2 "Land converted to Grassland" in EU 27 (kt CO_2)



Methodological issues for Land converted to Grassland category.

For estimating and reporting carbon stock changes in this subcategory, IPCC default methodology is generally used. The implementation of country-specific emission factors or default factors depends on which type of lands are being converted to Grassland, and on the estimated carbon pool. For instance, while some countries only consider a gross quantity of carbon loss from the conversion of forest lands to grassland, some others provide a net estimate on this carbon pool, by also considering one year of growth after the establishment of the grassland.

Usually, it is assumed that the carbon stored in living biomass and dead organic matter is lost in the year of the conversion, while for soil organic carbon in mineral soils, following IPCC methodology, countries often apply a 20-year transition period before the carbon stock of the soils converted to Grassland reach equilibrium.

Efforts devoted by the countries to assess soils organic carbon contents in these areas, have resulted in more accurate quantification of the carbon stock change that occurs in managed grassland and as a result of the conversion to and from grasslands.

6.4.5 Wetlands, Settlements and Other land (CRT Tables 4D, 4E, 4F)

6.4.5.1 Wetlands (CRT 4D)

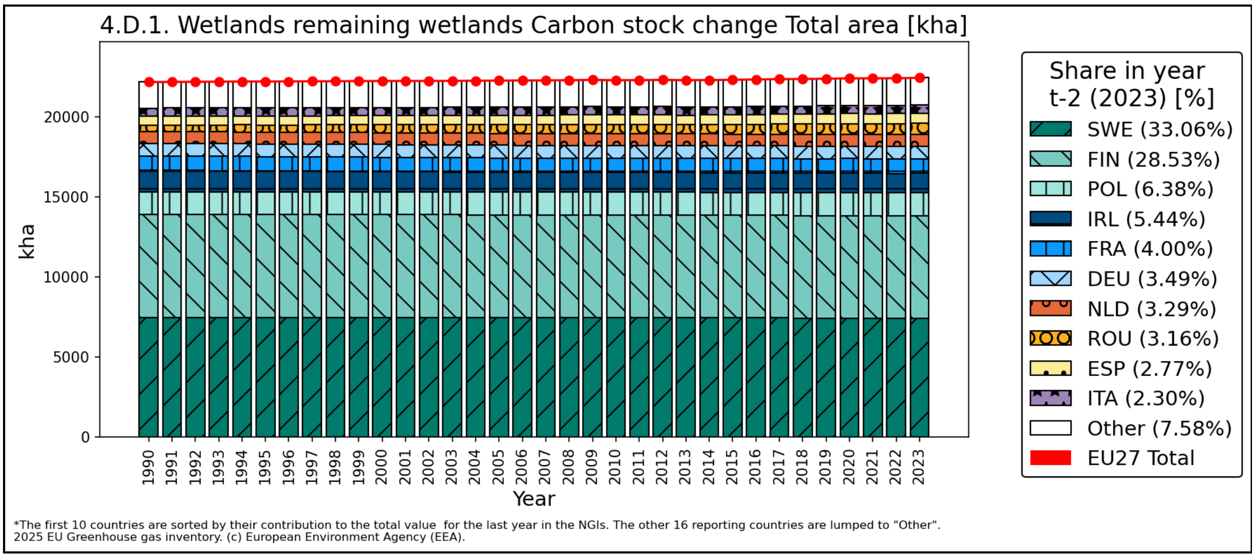
In terms of area, Wetlands represent 24 235 kha, which represents 6% of the total EU area. The category has shown a constant slight increase, resulting in about 2% more area in the reporting year, as compared to the base year.

The trend in areas show a fairly constant area of Wetlands dominated by Sweden and Finland, and mainly for the dominant subcategory of Wetlands remaining Wetlands (Figure 6.15).

In terms of emissions, Wetlands remaining Wetlands reaches for this inventory year about 12 688 ktCO_2. Subcategories, 4D1 and 4D2, have been overall reported as a net source of emissions, resulting mostly from countries reporting the productive management activities of peatland areas. On the other hand, in some countries these subcategories have been also reported as a net carbon sink.

The main driver of emissions in this category is indeed the occurrence of peat extraction areas, which even if affecting relatively small areas at country level has a big impact on the overall emissions from LULUCF. Within the EU, Germany, Finland, and Latvia are the main contributors of the emissions from Wetlands remaining wetlands (Table 6.17).

Figure 6.15 Trend of activity data and emissions (+)/removals (-) in subcategory 4D1 "Wetlands remaining Wetlands" in EU-27 (kha, Kt CO_2)



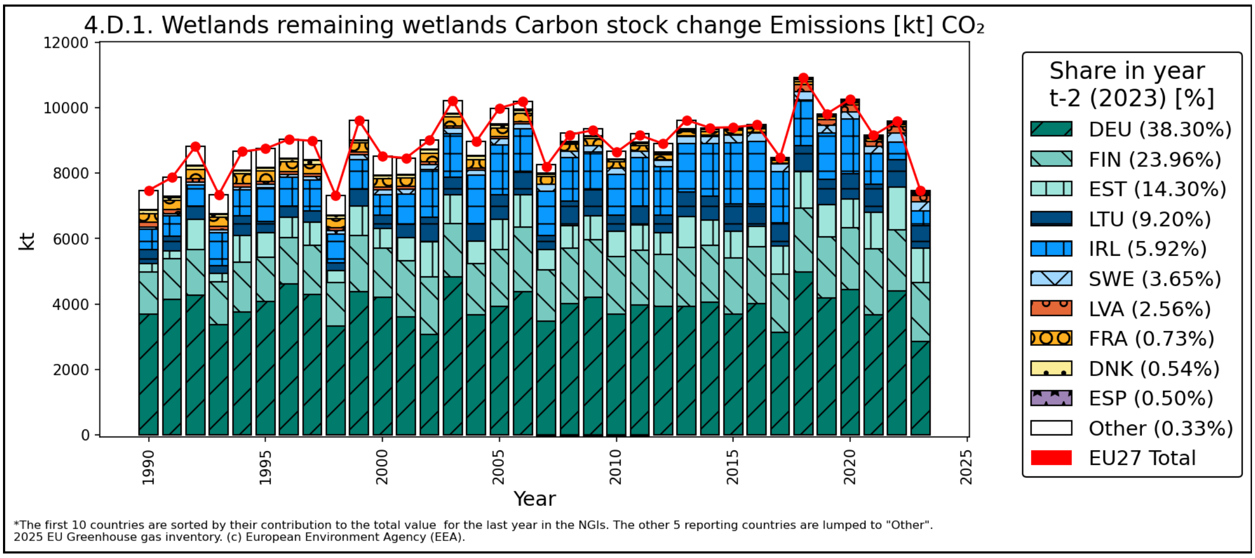


Table 6.17 CO_2 Emissions and removals from 4.D.1 wetlands remaining wetlands contributions to the net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	21	21	21	0.2%	0	0%	0	0%
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Czechia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Denmark	109	39	40	0.4%	-69	-63%	1	4%
Estonia	274	1 302	1 068	10.8%	794	290%	-234	-18%
Finland	1 278	1 867	1 790	18.0%	511	40%	-77	-4%
France	265	59	54	0.5%	-210	-79%	-5	-8%
Germany	3 696	4 404	2 861	28.8%	-835	-23%	-1 543	-35%
Greece	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Hungary	201	88	61	0.6%	-140	-70%	-27	-31%
Ireland	1 876	1 333	1 370	13.8%	-506	-27%	37	3%
Italy	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Latvia	986	1 655	1 650	16.6%	664	67%	-5	0%
Lithuania	423	837	688	6.9%	265	63%	-150	-18%
Luxembourg	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Malta	0	0	0	0.0%	0	-310%	0	0%
Netherlands	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Poland	578	12	13	0.1%	-565	-98%	1	10%
Portugal	NO	0	0	0.0%	0	∞	0	-9%
Romania	-3	NA,NO	NA,NO	-	3	100%	-	-
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Spain	31	38	38	0.4%	7	23%	0	0%
Sweden	68	278	273	2.7%	205	301%	-5	-2%
EU-27	**9 801**	**11 932**	**9 927**	**100%**	**126**	**1%**	**-2 005**	**-17%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

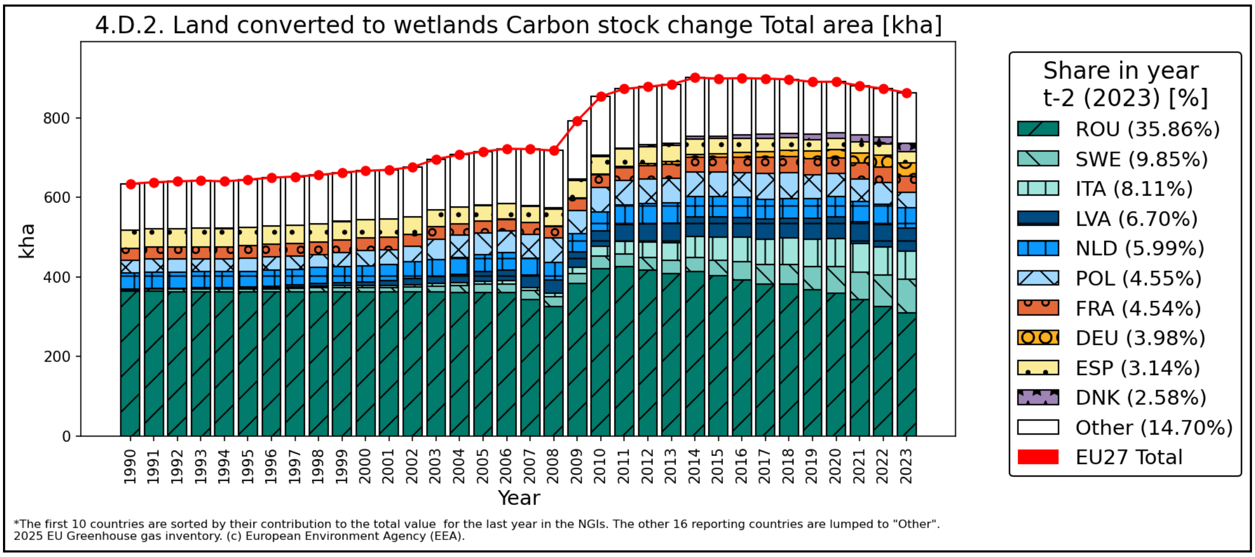
Abbreviations are explained in the Chapter 'Units and abbreviations'.

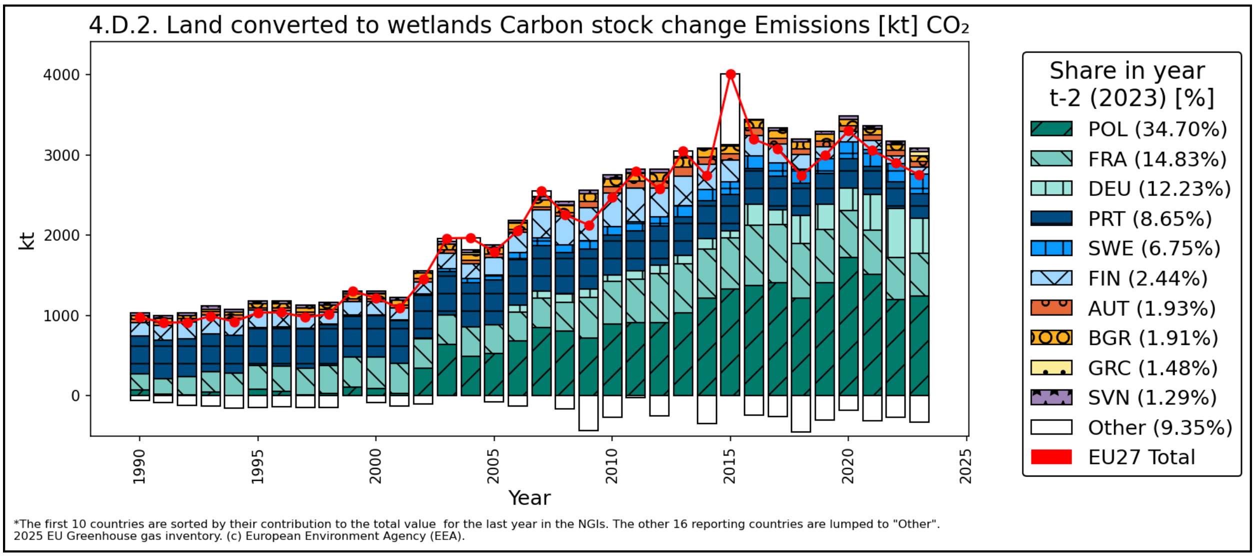
The other subcategory, Land converted to wetlands, represents only 7% of the wetlands area but results in about 22% of the final net emissions reported within the category. In terms of emissions this represents almost three times more than the reported emissions in the base year. The main drivers are Germany, Poland and France that all report larger areas in this sub-category in 2023 compared to 1990.

The area of land converted to wetlands is dominated by Romania, Sweden and Italy (Figure 6.18).

Nevertheless, these new areas are not always linked to carbon stock changes, as in some cases new wetlands areas are the result of the conversion of lands with insignificant carbon stocks to Other wetlands (i.e. mires and areas saturated by fresh water).

Figure 6.16 Trend of activity data and emissions (+) / removals (-) in subcategory 4D2 "Lands converted to Wetlands" in EU (kha, Kt CO_2)





Emissions in this subcategory are mainly reported by Poland, Finland and Germany because of the loss of carbon from the living biomass existing in the lands that are converted to wetlands (Table 6.18).

Table 6.18 CO_2 Emissions and removals from 4.D.2 land converted to wetlands contributions to the net CO_2 emissions (+)/removals (-) (CTF table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	44	69	69	2.5%	25	57%	0	0%
Belgium	12	10	9	0.3%	-3	-23%	-1	-6%
Bulgaria	40	72	68	2.5%	28	70%	-4	-5%
Croatia	77	12	13	0.5%	-64	-83%	1	4%
Cyprus	NO	0	0	0.0%	0	∞	0	0%
Czechia	23	79	25	0.9%	1	6%	-54	-69%
Denmark	0	-2	-22	-0.8%	-22	-4558%	-20	-876%
Estonia	6	18	14	0.5%	8	146%	-4	-23%
Finland	166	96	87	3.2%	-79	-47%	-8	-9%
France	201	531	531	19.2%	329	164%	0	0%
Germany	IE,NO	611	437	15.8%	437	∞	-174	-28%
Greece	NA,NO	1	53	1.9%	53	∞	52	5179%
Hungary	3	-3	-3	-0.1%	-6	-204%	0	-6%
Ireland	IE,NO	10	17	0.6%	17	∞	7	72%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	0	-14	-12	-0.5%	-13	-6396%	1	8%
Lithuania	63	NE,NO	NE,NO	-	-63	-100%	-	-
Luxembourg	0	1	1	0.0%	1	741%	0	-15%
Malta	0	NO	NO	-	0	100%	-	-
Netherlands	20	-19	-24	-0.9%	-44	-222%	-5	-23%
Poland	68	1 193	1 242	45.0%	1 173	1723%	49	4%
Portugal	475	328	309	11.2%	-165	-35%	-19	-6%
Romania	-121	-261	-249	-9.0%	-128	-105%	12	5%
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	40	44	46	1.7%	6	15%	2	4%
Spain	-143	-93	-93	-3.4%	50	35%	0	0%
Sweden	1	227	241	8.7%	241	44221%	14	6%
EU-27	**976**	**2 911**	**2 761**	**100%**	**1 785**	**183%**	**-150**	**-5%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

Abbreviations are explained in the Chapter 'Units and abbreviations'.

Most of the unmanaged land reported in the EU is found in this category. This explains why countries with the largest share of areas do not always report the largest emissions. Also lack of IPCC methods prevents countries from reporting GHG fluxes in some cases.

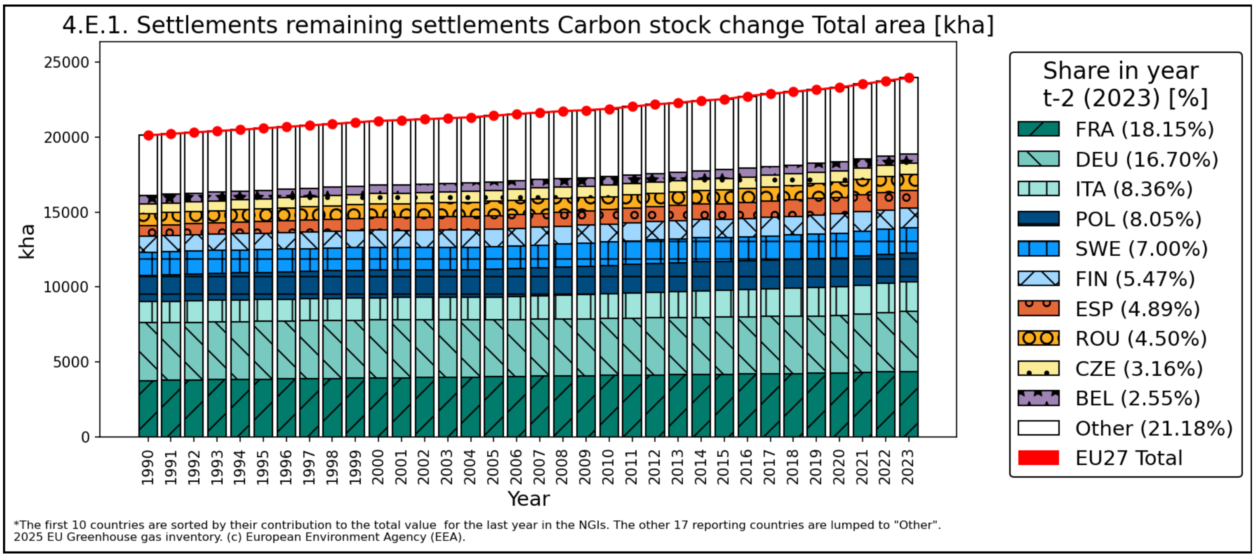
6.4.5.2 Settlements (CRT 4E)

In terms of area, this land use category represents 28 948 kha, which is 7% of the total reported area. For the year 2023, Settlements areas have resulted in an increase of 25% as compared with 1990.

In terms of emissions, this land use category is reported as a net source that reaches 35 378 kt CO_2 in 2023. Out of this, 84% are due to emissions resulting from Land converted to Settlement, which although in terms of area represents only 36% of the total category, results in significant emissions when forest, other woody lands, or high-carbon content soils are converted to urban areas.

As regards the methods used for reporting carbon stock changes in these areas, often countries used the tier 1 assumption of equilibrium under the subcategory 4E1, therefore no carbon stock changes are reported, and notation keys are accordingly included in the CRT tables. Nevertheless, a few countries have reported this subcategory as a net source of GHG emissions due to disturbed soils or net removals due to accumulation of living biomass.

Figure 6.17 Trend of activity data and emissions (+)/removals (-) in subcategory 4E1 "Settlements remaining Settlements" in EU (kha, kt CO_2)



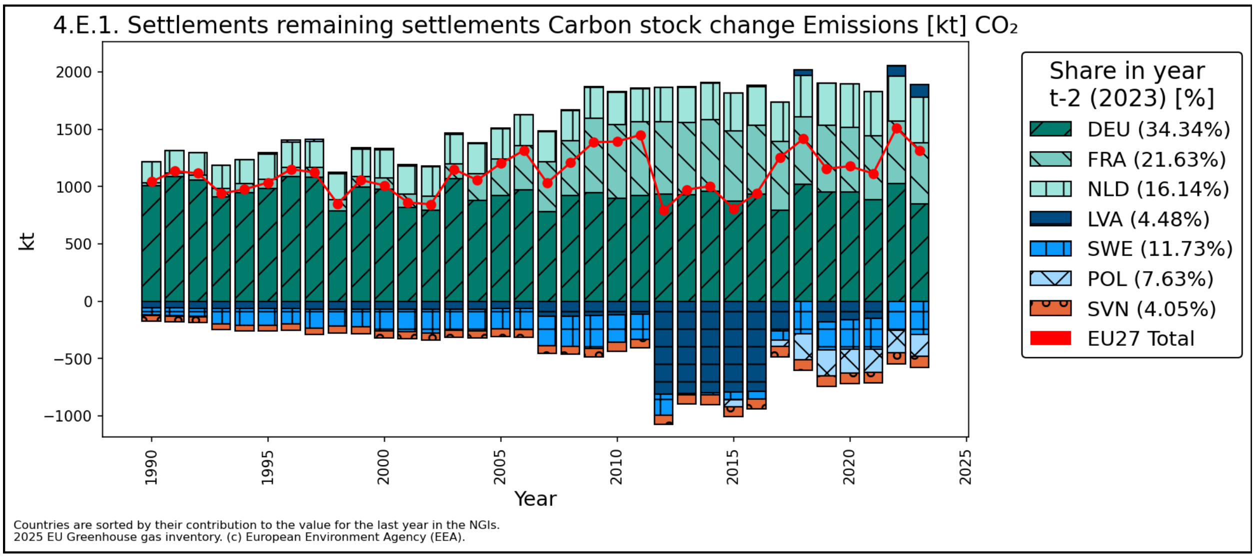
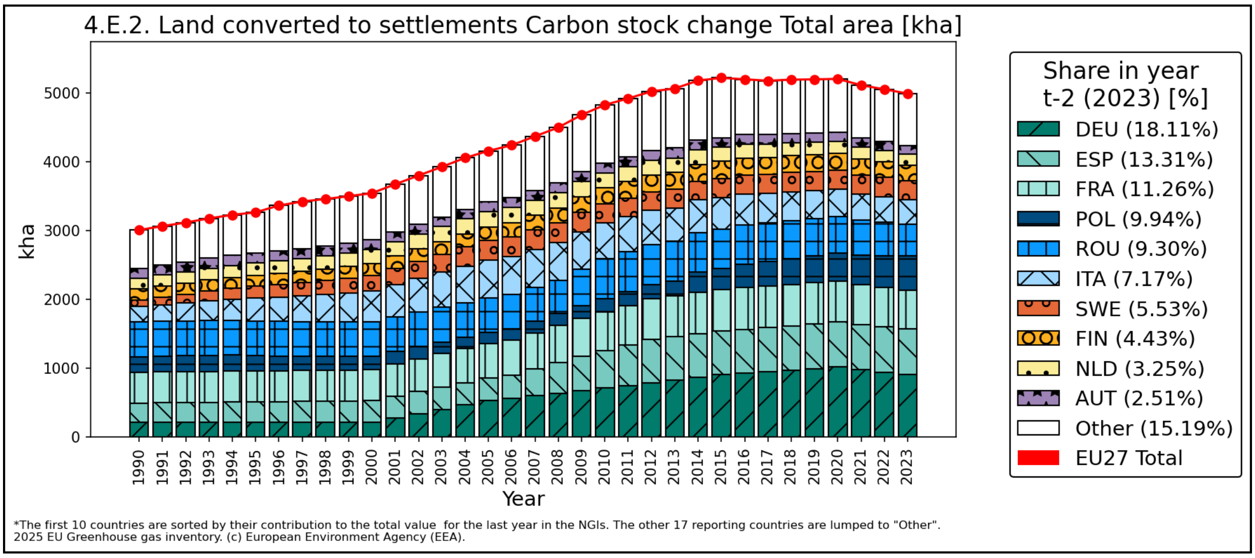
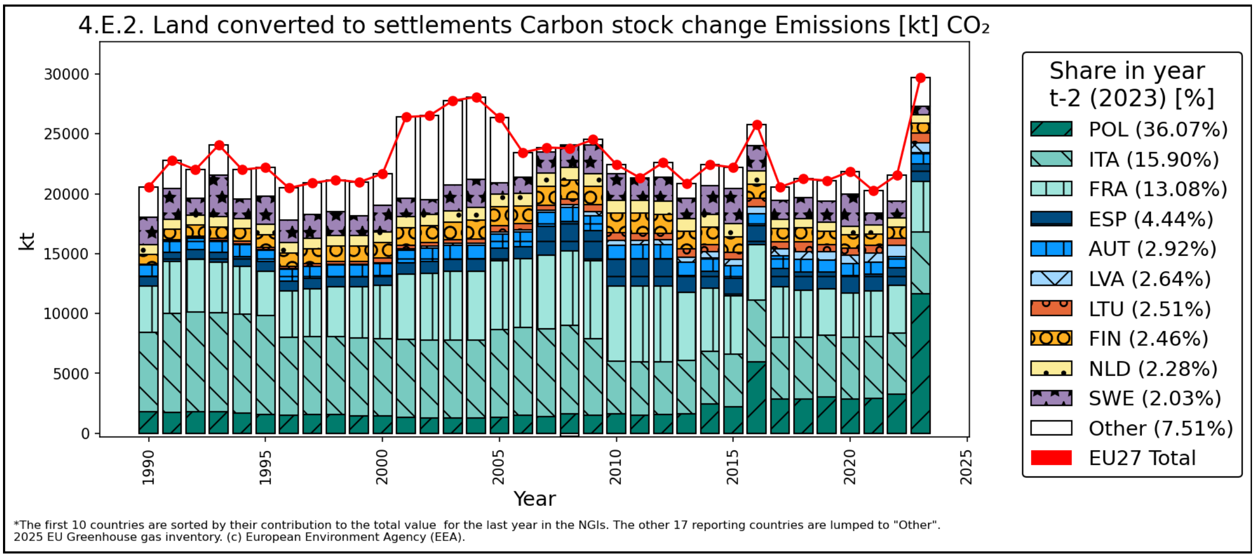


Figure 6.18 Trend of activity data and emissions (+)/removals (-) in subcategory 4E2 "Land converted to Settlements" in EU-27 kha, kt CO_2)





Regarding subcategory 4E2, annual emissions from Land converted to Settlements have increased by 44% since 1990 (Table 6.19). For the year 2023 this subcategory was reported as a net source of emissions, reaching 29 709 kt CO_2.

Emissions are mainly the result of disturbed mineral soils and loss of carbon from living biomass when forests are converted to urban areas. In fact, the conversion of forests to Settlements is an important component of the total deforestation. It represents around 30% of total area reported as deforested. While conversions to Wetland or Other land may be caused by natural effects, a conversion to Settlement is the result of human actions.

When a land is converted to Settlements, carbon pools are not uniformly disturbed over the whole area. For instance, usually only part of the converted area is paved, trees or upper soils layer is removed, and carbon stored in dead organic matter and soil organic matter diminish significantly. To address this issue, carbon stock changes associated with these deforestation events are reported using country-specific data and approaches.

Table 6.19 4E2 Land converted to Settlements: EU-27 contributions to the net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	935	958	945	3.2%	10	1%	-13	-1%
Belgium	137	497	498	1.7%	361	265%	1	0%
Bulgaria	104	164	328	1.1%	224	215%	164	100%
Croatia	235	587	546	1.8%	311	132%	-41	-7%
Cyprus	0	3	3	0.0%	2	530%	0	-10%
Czechia	468	269	268	0.9%	-200	-43%	-1	0%
Denmark	447	203	198	0.7%	-249	-56%	-5	-3%
Estonia	NE,NO	392	326	1.1%	326	∞	-66	-17%
Finland	857	929	796	2.7%	-61	-7%	-132	-14%
France	3 894	3 981	4 230	14.2%	337	9%	250	6%
Germany	-686	-1 507	-1 321	-4.4%	-635	-93%	186	12%
Greece	50	130	125	0.4%	76	152%	-5	-4%
Hungary	96	171	236	0.8%	141	147%	65	38%
Ireland	60	144	122	0.4%	62	103%	-22	-15%
Italy	6 640	5 142	5 142	17.3%	-1 497	-23%	1	0%
Latvia	64	957	854	2.9%	791	1240%	-103	-11%
Lithuania	6	579	812	2.7%	806	13587%	233	40%
Luxembourg	43	28	26	0.1%	-17	-39%	-2	-5%
Malta	2	2	2	0.0%	0	10%	0	0%
Netherlands	806	741	738	2.5%	-68	-8%	-3	0%
Poland	1 783	3 241	11 671	39.3%	9 888	555%	8 429	260%
Portugal	173	60	70	0.2%	-103	-60%	10	17%
Romania	850	669	654	2.2%	-196	-23%	-15	-2%
Slovakia	97	80	77	0.3%	-20	-20%	-3	-4%
Slovenia	462	277	270	0.9%	-192	-42%	-7	-3%
Spain	776	1 430	1 437	4.8%	662	85%	7	0%
Sweden	2 277	1 447	655	2.2%	-1 622	-71%	-791	-55%
EU-27	**20 574**	**21 575**	**29 709**	**100%**	**9 135**	**44%**	**8 135**	**38%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.

Abbreviations are explained in the Chapter 'Units and abbreviations'.

Member States that contribute the most to the sub-category in 2023 are Poland, Italy and France. The large increase in emissions from 2022 to 2023 is almost entirely due to emissions from the loss of biomass reported by Poland.

For reporting carbon stock changes in dead organic matter, it is generally assumed that all the carbon stock in the pool is instantaneously oxidized in the moment of conversion from Forest land to Settlements. It is also assumed that there is no dead wood and litter on Settlements. Emissions are estimated based on average carbon stock per area of these carbon pools, determined either at national or regional scale or specific to each deforestation site.

For reporting soil organic matter, different assumptions have been implemented by MS. These are generally based on expert judgment or, occasionally, on scientific studies. Associated carbon stocks are derived from one of the following options (depending on MS):

- data from measurements in green area of the city (from scientific studies);
- same carbon stock as under 'GL remaining GL' (assuming that under national circumstances GL is the source of land for Settlement's expansion);

- lowest carbon stock value among the major land categories Forest land, Cropland and Grassland (assuming limited change of carbon stock in the soil under construction);
- applying a factor against carbon stock in previous land use (e.g., constant loss of 50%).

6.4.5.3 Other land (CRT 4F)

The land use category Other land reached in this reporting year 9 287 Kha, which represents about 2% of the total reported area. This land use category has been reported rather constant across the time series because of the balance among the decrease in the subcategory 4F1 and the increase in the subcategory 4F2.

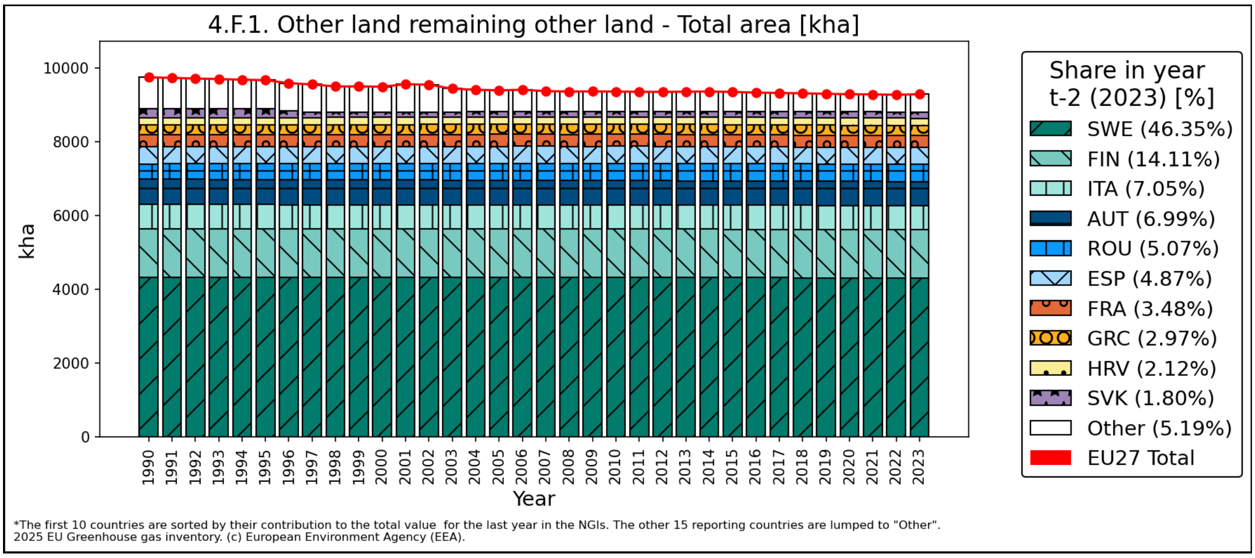
The largest areas under the category 4F1 are reported by Sweden (Figure 6.19), while new Other lands areas in the subcategory 4F2 are mainly reported by Poland, Romania and Slovakia (Figure 6.20).

In terms of emissions, the trend is driven by Austria, Netherlands, and Slovakia (Figure 6.20).

Definitions of Other land are close to each other among countries and overall match the IPCC general description (Table 6.9). In most cases, following the IPCC approach, this category is used to ensure that the total area reported under LULUCF remains constant along the time series, and matches official country area. To this aim, this land category is on a lower level of hierarchy and includes all the areas that were not identified under any other land use category, and that are in all cases considered unmanaged.

In terms of emissions, Other land represents a small source of emissions of 1 144 Kt CO_2. Countries generally report emissions as a result of carbon oxidation from living biomass and soils when lands are converted to Other land.

Figure 6.19 Trend of activity data in subcategories 4F1 and 4F2 "Other land remaining Other Land" and "Land converted to Other land" in EU (kha)



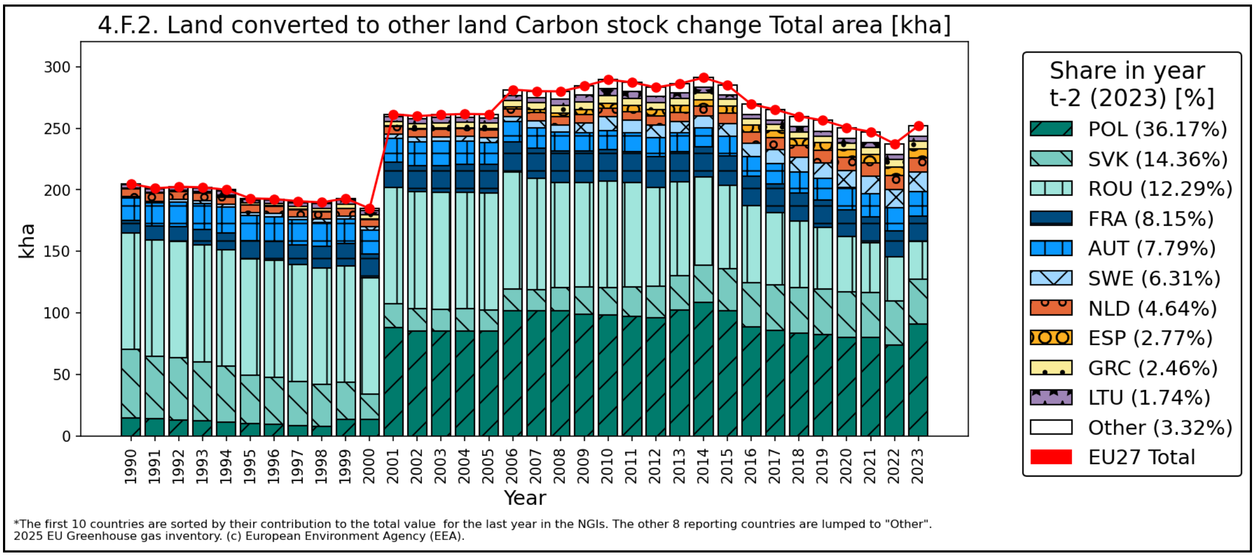
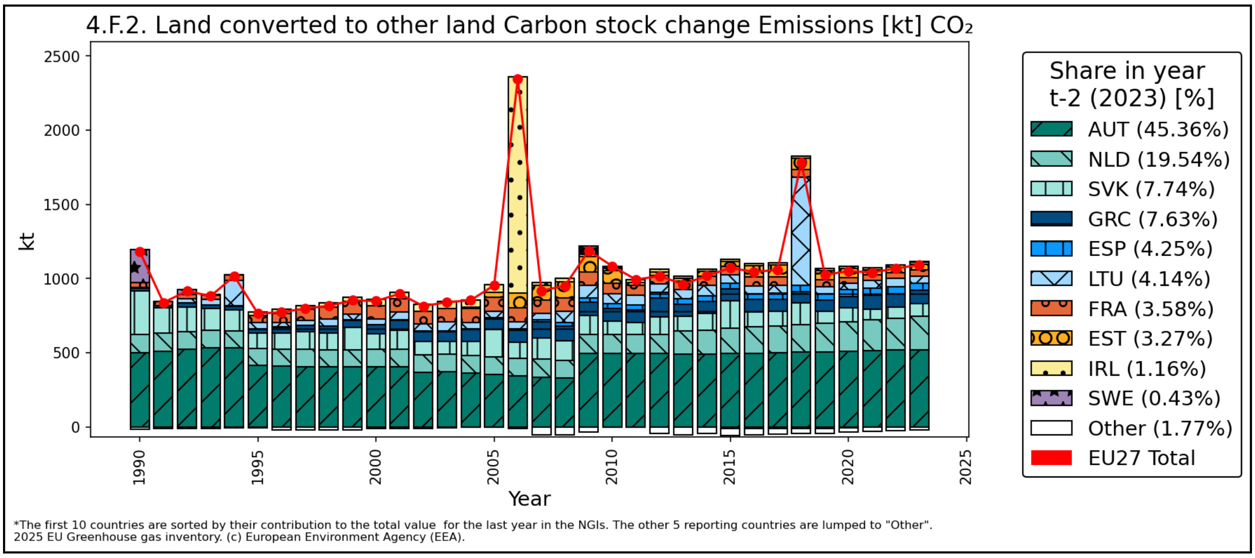


Figure 6.20 Trend of emissions (+)/removals (-) in subcategory 4F2, "Land converted to Other lands" in EU-27 (kt CO_2)



6.4.6 Harvested wood products (CRT 4.G)

This carbon pool covers emissions and removals from carbon stock changes in harvested wood products (HWPs). The net contribution of this pool is the result of the annual carbon inflow to the pool (i.e., gains), and carbon outflow from the pool (i.e., losses) arising from previous years production.

According to the 2006 IPCC guidelines, HWPs includes all wood material (including bark) that leaves harvest sites, where this removal is initially counted as a loss of carbon from living biomass. Slash and other material left at harvest sites should be regarded as dead organic matter in the associated land use category and not as HWP. The inflow of biomass into the HWPs is counted as a gain in the HWPs category.

HWPs represent at the level of EU MS a net carbon sink of –30 482 kt CO_2 in the current inventory year (Table 6.20). Most of the countries reported this carbon pool as a net sink; however, some countries, and for certain years, reported this pool as a net source. The main contributors to the carbon sink are Sweden, Germany and Poland.

The methods and data sources for estimating carbon stock changes in HWPs are consistent with methodologies provided by 2006 IPCC GL. Individual inventories implement the IPCC Approach B (i.e., production approach) to provide estimates on HWPs consistently with the reporting of the carbon pool under the KP reporting and subsequently according to EU Regulations No 2018/841. This implies that only HWP from domestic harvested wood is reported as an inflow to the HWP pool,

Countries reported carbon stock changes in HWPs considering individual estimates for the semi-finished wood products categories of (i) Solid wood, disaggregated into Sawn wood and wood panels, and (ii) Paper and paperboard. To this aim, the IPCC default half-life values have been used by all individual inventories.

A particular case is given by Malta that has stated that carbon stock changes in HWPs pool, as considered under the Approach B, do not exist, as commercial logging does not occur in its territory.

With regards to the activity data, most of the MS have based their estimates on the information provided by the FAOSTAT database, the TIMBER database of the United Nations Economic Commission for Europe (UNECE, 2011), national statistics when available, or, in specific cases, on information collected by surveying wood industries.

Table 6.20 4G harvested wood products: EU-27 contributions to the net CO_2 emissions (+)/removals (-) (CRT table 4)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	-3 122	-1 992	-678	2.2%	2 444	78%	1 314	66%
Belgium	-1 516	11	209	-0.7%	1 725	114%	198	1837%
Bulgaria	-583	-972	-1 242	4.1%	-659	-113%	-270	-28%
Croatia	-318	-393	-391	1.3%	-74	-23%	2	0%
Cyprus	2	20	19	-0.1%	17	805%	-1	-4%
Czechia	-1 680	-1 979	-1 248	4.1%	432	26%	731	37%
Denmark	-2	-98	-111	0.4%	-109	-4592%	-13	-13%
Estonia	-156	-663	-502	1.6%	-346	-221%	161	24%
Finland	-2 952	-3 286	-1 596	5.2%	1 355	46%	1 689	51%
France	-5 368	-1 263	-486	1.6%	4 882	91%	777	62%
Germany	-1 341	-4 282	-4 604	15.1%	-3 264	-243%	-323	-8%
Greece	-349	28	27	-0.1%	376	108%	0	-1%
Hungary	-315	-916	-494	1.6%	-179	-57%	422	46%
Ireland	-413	-883	-887	2.9%	-474	-115%	-4	0%
Italy	-388	-426	-524	1.7%	-136	-35%	-98	-23%
Latvia	-166	-1 979	-2 300	7.5%	-2 133	-1284%	-321	-16%
Lithuania	-240	-1 893	-1 668	5.5%	-1 428	-595%	225	12%
Luxembourg	2	-4	-7	0.0%	-9	-444%	-3	-88%
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	-69	130	124	-0.4%	193	282%	-5	-4%
Poland	-459	-4 702	-4 675	15.3%	-4 216	-918%	27	1%
Portugal	-2 127	-361	-265	0.9%	1 863	88%	96	27%
Romania	354	-1 576	-1 094	3.6%	-1 448	-409%	483	31%
Slovakia	-470	-144	-292	1.0%	179	38%	-148	-102%
Slovenia	-67	-305	-271	0.9%	-204	-304%	34	11%
Spain	-2 020	-2 725	-2 541	8.3%	-521	-26%	184	7%
Sweden	-5 007	-7 652	-4 987	16.4%	20	0%	2 665	35%
EU-27	**-28 770**	**-38 305**	**-30 482**	**100%**	**-1 713**	**-6%**	**7 823**	**20%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

While the harvested wood products pool has slowed a small increase of 6% in net removals from 1900 to 2023 mainly driven by Poland, Germany and Latvia, it also showed a significant decrease from 2022 to 2023 of 20%. This is mainly driven by Sweden, Finland and Austria, MS that also report a declining forest sink in the 4.A category, which illustrates that the correlation between forest sink, harvest and harvested wood products is rather complicated. A declining forest sink is not necessarily resulting in more removals from harvested wood products.

6.4.7 Other sources of emissions: Tables 4(I)-4(IV)

6.4.7.1 Direct nitrous oxide (N_2O) emissions from nitrogen (N) inputs to managed soils (CRT Table 4(I))

Under CRT table 4(I) countries report N_2O emissions resulting from the addition of organic and inorganic fertilizers to managed soils under land use categories other than Cropland and Grassland.

The majority of countries have stated that fertilization is not part of the management practices of forests, while, if any, emissions from the addition of nitrogen inputs in Wetlands, Settlements, or in a few cases also under forests, are reported under Agriculture sector when it is not possible to separate emissions from fertilization among the land use categories. Therefore, under the LULUCF almost all the countries have reported these emissions using the notation key NO or IE.

Activity data for reporting this source of emissions results from national or sectorial statistics (e.g. sales statistics), which provide the total amount and type of fertilizer. Then, the IPCC default value of 0.01 kg N_2O-N/kg N yr^{-1} is usually used to derive N_2O emissions from nitrogen inputs to managed soils.

The table below shows information in terms of reported emission from this source at country level and for the years 1990, (t-3) and (t-2)

Table 6.21. 4 LULUCF Direct nitrous oxide (N_2O) emissions from nitrogen (N) inputs to managed soils (kt CO_2 eq.)

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	NO	NO	NO	-	-	-	-	-
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	NO	NO	NO	-	-	-	-	-
Croatia	NO	NO	NO	-	-	-	-	-
Cyprus	NO	NO	NO	-	-	-	-	-
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-
Estonia	NO	NO	NO	-	-	-	-	-
Finland	31	11	61	86.8%	30	96%	50	462%
France	NO	NO	NO	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-
Greece	NO	NO	NO	-	-	-	-	-
Hungary	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Ireland	IE	IE	IE	-	-	-	-	-
Italy	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Latvia	IE	IE	IE	-	-	-	-	-
Lithuania	NO	NO	NO	-	-	-	-	-
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	NO	NO	NO	-	-	-	-	-
Poland	IE	IE	IE	-	-	-	-	-
Portugal	IE	IE	IE	-	-	-	-	-
Romania	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	NO	NO	NO	-	-	-	-	-
Sweden	44	6	9	13.2%	-34	-79%	3	51%
EU-27	**75**	**17**	**70**	**100%**	**-4**	**-6%**	**53**	**313%**

6.4.7.2 .Emissions and removals from drainage and rewetting and other management of organic and mineral soils (CRT Table 4(II))

Under CRT table 4(II), CO_2, CH_4 and N_2O emissions and removals from drainage and rewetting and other management of organic and mineral soils areas are reported. However, part of these emissions is already covered under other sectors, so countries need to avoid double counting (e.g., nitrous oxide emissions from drained cropland and grassland soils are covered in the agriculture sector) or they may be reported under other tables within the LULUCF (e.g., CO_2 emissions or removals from drainage of wetlands areas are often already included in CRT tables 4.A to 4.F).

The tables below shows information in terms of reported emission from this source at country level and for the years 1990, (t-3) and (t-2)

Table 6.22 4 LULUCF CO_2 Emissions and removals from drainage and rewetting and other management of organic and mineral soils (kt CO_2 eq.)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	896	896	896	11.1%	0	0%	0	0%
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Croatia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Cyprus	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	227	117	115	1.4%	-112	-49%	-3	-2%
Estonia	IE,NE,NO	IE,NE,NO	IE,NE,NO	-	-	-	-	-
Finland	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
France	425	425	425	5.3%	0	0%	0	0%
Germany	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Greece	NO	NO	NO	-	-	-	-	-
Hungary	196	76	49	0.6%	-147	-75%	-27	-35%
Ireland	1 203	1 063	1 064	13.2%	-139	-12%	1	0%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	856	1 590	1 589	19.7%	733	86%	-1	0%
Lithuania	3 646	3 737	3 739	46.3%	93	3%	2	0%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	E,NA,NE,NO	E,NA,NE,NO	IE,NA,NE,NO	-	-	-	-	-
Poland	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-
Romania	204	204	204	2.5%	0	0%	0	0%
Slovakia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	0	0	0	0.0%	0	23%	0	0%
Sweden	IE	IE	IE	-	-	-	-	-
EU-27	**7 655**	**8 109**	**8 083**	**100%**	**428**	**6%**	**-27**	**0%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

Table 6.23 4 LULUCF N_2O Emissions and removals from drainage and rewetting and other management of organic and mineral soils (kt CO_2 eq.)

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	21	21	21	0.4%	0	0%	0	0%
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Croatia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Cyprus	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	29	21	21	0.5%	-8	-28%	0	0%
Estonia	239	244	244	5.2%	5	2%	0	0%
Finland	1 453	1 756	1 754	37.7%	301	21%	-2	0%
France	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Germany	449	505	441	9.5%	-8	-2%	-64	-13%
Greece	NO	NO	NO	-	-	-	-	-
Hungary	0	2	2	0.0%	1	271%	0	0%
Ireland	167	245	244	5.2%	77	46%	-2	-1%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	483	508	448	9.6%	-35	-7%	-60	-12%
Lithuania	327	368	369	7.9%	42	13%	1	0%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	1	1	1	0.0%	0	-5%	0	-1%
Poland	4	5	6	0.1%	2	47%	0	8%
Portugal	NO	NO	NO	-	-	-	-	-
Romania	NO	NO	NO	-	-	-	-	-
Slovakia	NO	NO	NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	0	0	0	0.0%	0	23%	0	0%
Sweden	1 064	1 105	1 105	23.7%	41	4%	1	0%
EU-27	**4 238**	**4 782**	**4 657**	**100%**	**419**	**10%**	**-125**	**-3%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'

Table 6.24 4 LULUCF CH_4 Emissions and removals from drainage and rewetting and other management of organic and mineral soils (kt CO_2 eq.)

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	37	37	37	0.2%	0	0%	0	0%
Belgium	NO	NO	NO	-	-	-	-	-
Bulgaria	NE,NO	NE,NO	NE,NO	-	-	-	-	-
Croatia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Cyprus	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Czechia	NO	NO	NO	-	-	-	-	-
Denmark	388	390	397	2.7%	8	2%	7	2%
Estonia	75	78	78	0.5%	3	3%	0	0%
Finland	1 891	927	925	6.2%	-966	-51%	-2	0%
France	18	18	18	0.1%	0	0%	0	0%
Germany	7 349	6 405	7 742	52.2%	393	5%	1 336	21%
Greece	NO	NO	NO	-	-	-	-	-
Hungary	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Ireland	3 996	3 609	3 646	24.6%	-350	-9%	37	1%
Italy	NO	NO	NO	-	-	-	-	-
Latvia	495	877	880	5.9%	385	78%	3	0%
Lithuania	3	2	2	0.0%	0	-3%	0	0%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	0	NO	NO	-	0	-100%	-	-
Netherlands	577	590	588	4.0%	11	2%	-2	0%
Poland	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-
Romania	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Slovakia	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Slovenia	NO	NO	NO	-	-	-	-	-
Spain	0	0	0	0.0%	0	23%	0	0%
Sweden	613	534	532	3.6%	-81	-13%	-1	0%
EU-27	**15 443**	**13 466**	**14 844**	**100%**	**-599**	**-4%**	**1 377**	**10%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'

6.4.7.3 Direct nitrous oxide and indirect (N_2O) emissions from nitrogen (N) mineralization/immobilization associated with loss/gain of soil organic matter resulting from change of land use or management of mineral soils (CRT Table 4(III))

Under CRT table 4(III), direct nitrous oxide emissions from nitrogen mineralization associated with loss of soil organic matter resulting from change of land use or management of mineral soils are reported by almost all countries. This indicates significant efforts devoted by countries to increase the completeness of reporting for this source of emissions during the last years.

The tables below shows information in terms of reported emission from this source at country level and for the years 1990, (t-3) and (t-2)

Table 6.25 Direct nitrous oxide (N_2O) emissions from nitrogen (N) mineralization/immobilization associated with loss/gain of soil organic matter resulting from change of land use or management of mineral soils (kt CO_2 eq.)

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	143	135	133	2.4%	-10	-7%	-2	-1%
Belgium	2	39	40	0.7%	38	2476%	0	1%
Bulgaria	54	80	83	1.5%	29	54%	3	4%
Croatia	44	149	142	2.5%	98	223%	-7	-5%
Cyprus	0	1	1	0.0%	1	6664%	0	-14%
Czechia	8	2	2	0.0%	-6	-71%	0	0%
Denmark	44	20	21	0.4%	-23	-53%	1	4%
Estonia	0	20	21	0.4%	21	87953%	0	1%
Finland	23	82	68	1.2%	45	199%	-13	-17%
France	1 518	537	555	9.9%	-963	-63%	18	3%
Germany	247	349	391	6.9%	144	59%	42	12%
Greece	1	14	14	0.3%	13	1125%	0	2%
Hungary	13	27	27	0.5%	15	116%	0	1%
Ireland	7	11	9	0.2%	2	31%	-2	-14%
Italy	518	448	478	8.5%	-40	-8%	30	7%
Latvia	0	58	62	1.1%	62	100%	4	7%
Lithuania	69	91	102	1.8%	34	49%	11	12%
Luxembourg	11	2	2	0.0%	-9	-82%	0	-8%
Malta	0	1	1	0.0%	0	76%	0	-2%
Netherlands	117	97	100	1.8%	-16	-14%	3	3%
Poland	1 532	1 785	2 928	52.0%	1 395	91%	1 143	64%
Portugal	116	149	142	2.5%	27	23%	-7	-5%
Romania	195	69	106	1.9%	-88	-45%	37	54%
Slovakia	98	17	16	0.3%	-82	-84%	-1	-6%
Slovenia	51	27	27	0.5%	-25	-48%	-1	-3%
Spain	198	144	138	2.5%	-59	-30%	-6	-4%
Sweden	6	19	19	0.3%	13	210%	0	0%
EU-27	**5 014**	**4 373**	**5 629**	**100%**	**615**	**12%**	**1 256**	**29%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'

6.4.7.4 CO_2, CH_4 & N_2O emissions from Biomass Burning (CRT Table 4(IV))

This source category covers CO_2, and non-CO_2 emissions from biomass burning because of wildfires and controlled burning, affecting all land use categories.

Following the IPCC approach, many countries that implement the stock-different method to estimate carbon stock changes in forest living biomass use the notation key IE in the CRT table 4(IV), so avoiding double counting of CO_2 emissions. In addition, countries have also used the notation keys NO or NA when wildfires or controlled burning have not taken place under certain categories, or NE for those land use categories for which the IPCC does not provide methods. An example is the reporting of emissions from biomass burning in Settlement (e.g., Estonia).

In general, countries informed that controlled burning on managed lands is not a common practice. With few exceptions for confined areas that are reported by Finland and Sweden in forest lands and Spain in grasslands. In general, northern countries report generally low emissions from biomass burning (i.e., controlled burning and wildfires).

Methodologies used to report CO_2 emissions from fires are always based on tier 2 methods by using information on activity data provided by national statistics and country-specific emission factors. By contrary, tier 1 methodologies are used for estimation of CH_4 and N_2O emissions resulting from fires.

The tables below (Table 6.26 ,Table 6.27 and Table 6.28). shows information in terms of reported emission from this source at country level and for the years 1990, (t-3) and (t-2). However, emissions from biomass burning do not show a clear trend since their occurrence is in many cases beyond the control of the countries. In Mediterranean territories the occurrence of wildfires in certain years result in enormous GHG emissions that are clearly identified in the trend of the LULUCF sector.

Overall, this source of emissions presents a very variable trend and interannual variability that is related to several factors, in many cases driven by climate conditions. It is well known that the countries that often report the larger quantities of emissions from biomass burning are Italy, France, Spain, and Greece. However, it is remarkable that during the last years more central and northern countries are also reporting significant number of emissions from this source as a result of the impact of wildfires in their territories.

Table 6.26 CO_2 emissions from Biomass Burning (in kt CO_2)

Member State	CO2 Emissions in kt			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2	%	kt CO2	%
Austria	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Belgium	IE,NO	NO	3	0.1%	3	∞	3	∞
Bulgaria	IE,NE,NO	IE,NE,NO	IE,NE,NO	-	-	-	-	-
Croatia	15	381	10	0.4%	-5	-33%	-371	-97%
Cyprus	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Czechia	16	203	26	1.1%	10	60%	-177	-87%
Denmark	IE,NA	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Estonia	IE,NE,NO	IE,NE,NO	IE,NE,NO	-	-	-	-	-
Finland	0	0	0	0.0%	0	-98%	0	-94%
France	2 629	3 091	215	8.9%	-2 414	-92%	-2 876	-93%
Germany	IE,NO	IE,NO	IE,NO	-	-	-	-	-
Greece	IE,NO	0	9	0.4%	9	∞	9	7678%
Hungary	IE,NA,NO	IE,NA,NO	IE,NA,NO	-	-	-	-	-
Ireland	474	77	227	9.4%	-247	-52%	150	194%
Italy	5 072	2 116	948	39.1%	-4 124	-81%	-1 168	-55%
Latvia	23	29	81	3.4%	58	247%	52	179%
Lithuania	1	0	0	0.0%	-1	-69%	0	-4%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	5	7	7	0.3%	2	48%	0	1%
Poland	107	23	31	1.3%	-76	-71%	7	30%
Portugal	9 342	2 112	640	26.4%	-8 703	-93%	-1 472	-70%
Romania	9	271	12	0.5%	3	30%	-259	-95%
Slovakia	47	361	9	0.4%	-38	-81%	-352	-98%
Slovenia	15	109	0	0.0%	-15	-97%	-108	-100%
Spain	545	558	204	8.4%	-341	-63%	-355	-64%
Sweden	IE,NO	IE,NO	IE,NO	-	-	-	-	-
EU-27	**18 302**	**9 339**	**2 422**	**100%**	**-15 880**	**-87%**	**-6 917**	**-74%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'

Table 6.27 CH_4 emissions from Biomass Burning (in kt CO_2 eq.)

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	1	1	0	0.0%	0	-27%	0	-48%
Belgium	0	NO	0	0.0%	0	47%	0	∞
Bulgaria	3	21	25	1.6%	22	809%	3	17%
Croatia	1	37	2	0.1%	0	13%	-36	-96%
Cyprus	0	0	0	0.0%	0	910%	0	20%
Czechia	19	21	4	0.3%	-15	-77%	-16	-79%
Denmark	1	0	0	0.0%	-1	-99%	0	-66%
Estonia	0	0	0	0.0%	0	-53%	0	577%
Finland	3	1	2	0.1%	-2	-52%	1	161%
France	618	518	403	26.8%	-215	-35%	-115	-22%
Germany	10	20	8	0.5%	-2	-20%	-12	-60%
Greece	70	62	533	35.5%	463	660%	471	759%
Hungary	22	73	11	0.7%	-11	-50%	-62	-85%
Ireland	96	15	47	3.1%	-49	-51%	32	218%
Italy	727	375	193	12.9%	-534	-73%	-182	-48%
Latvia	28	12	9	0.6%	-19	-68%	-3	-26%
Lithuania	3	0	0	0.0%	-3	-93%	0	-42%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	0	1	1	0.0%	0	50%	0	1%
Poland	55	22	10	0.7%	-45	-81%	-12	-53%
Portugal	574	148	47	3.1%	-527	-92%	-101	-68%
Romania	1	47	15	1.0%	14	1804%	-32	-68%
Slovakia	12	46	15	1.0%	3	22%	-31	-67%
Slovenia	1	9	0	0.0%	-1	-97%	-9	-100%
Spain	351	395	173	11.5%	-178	-51%	-221	-56%
Sweden	2	2	3	0.2%	1	32%	1	62%
EU-27	**2 601**	**1 826**	**1 503**	**100%**	**-1 098**	**-42%**	**-323**	**-18%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter ‘Units and abbreviations’.

Table 6.28 N_2O emissions from Biomass Burning (in kt CO_2 eq.)

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%
Austria	0	0	0	0.1%	0	-15%	0	-41%
Belgium	0	NO	0	0.0%	0	98%	0	∞
Bulgaria	1	11	13	2.8%	11	809%	2	17%
Croatia	1	21	1	0.2%	0	39%	-20	-95%
Cyprus	0	0	0	0.0%	0	910%	0	20%
Czechia	10	11	2	0.5%	-8	-77%	-8	-79%
Denmark	0	0	0	0.0%	0	-99%	0	-66%
Estonia	0	0	0	0.0%	0	-57%	0	277%
Finland	2	0	1	0.2%	-1	-52%	1	159%
France	206	190	128	27.8%	-78	-38%	-63	-33%
Germany	5	10	4	0.9%	-1	-20%	-6	-60%
Greece	5	3	26	5.8%	22	479%	23	762%
Hungary	14	41	6	1.3%	-8	-57%	-35	-86%
Ireland	21	3	11	2.3%	-11	-50%	7	246%
Italy	381	196	101	22.1%	-279	-73%	-95	-48%
Latvia	3	1	1	0.2%	-2	-66%	0	-28%
Lithuania	3	0	0	0.0%	-3	-94%	0	-47%
Luxembourg	NO	NO	NO	-	-	-	-	-
Malta	NO	NO	NO	-	-	-	-	-
Netherlands	0	0	0	0.1%	0	49%	0	1%
Poland	29	12	5	1.2%	-23	-81%	-6	-53%
Portugal	145	37	12	2.6%	-133	-92%	-26	-68%
Romania	0	33	13	2.8%	12	2957%	-20	-62%
Slovakia	7	24	8	1.7%	1	22%	-16	-67%
Slovenia	1	5	0	0.0%	-1	-97%	-5	-100%
Spain	253	275	125	27.4%	-128	-51%	-150	-54%
Sweden	0	0	0	0.0%	0	-10%	0	11%
EU-27	**1 087**	**876**	**458**	**100%**	**-628**	**-58%**	**-418**	**-48%**

Note: Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period.
Abbreviations are explained in the Chapter 'Units and abbreviations'.

6.5 Uncertainties

The table below shows information on the uncertainties that have been estimated for the LULUCF sector. Specifically, the uncertainty of the LULUCF sector is estimated, respectively for the level, and trend as 46.8%, and 121.1%.

The uncertainty assessment shows significant changes compared with the previous EU GHG inventory submission, especially regarding the trend uncertainty. Recalculations of emissions/removals, revisions of uncertainties and changes in the resolution of the Member States' uncertainty reporting all influence the sector uncertainties. Therefore, changes in uncertainty estimates between submissions can hardly be attributed to a single cause. Nonetheless, a large part of the increase in LULUCF trend uncertainties can be attributed to Finland's revision of its 4A CO_2 uncertainty estimation (from 144% in 2024 to 935% in 2025). Additionally, Finland's share in the EU total of category 4A (CO_2 emissions) decreased from 8% in 1990 to 0.4% in 2023. Both developments influence the EU trend uncertainty. For more detailed information on Member States' uncertainties please refer to the Member States' submissions.

For more information on the uncertainty analysis please refer to chapter 1.6.

Table 6.29 Level and trend uncertainty assessment of the annual EU emission/removal on LULUCF land subcategories and GHG sources.

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
4.A Forest Land	CO_2	-359 130	-266 886	-25.7%	25.6%	79.8%
4.A Forest Land	CH_4	1 316	1 093	-17.0%	62.1%	27.3%
4.A Forest Land	N_2O	2 522	2 376	-5.8%	60.3%	5.6%
4.B Cropland	CO_2	70 490	30 788	-56.3%	106.6%	24.2%
4.B Cropland	CH_4	934	956	2.3%	49.9%	17.6%
4.B Cropland	N_2O	2 265	1 164	-48.6%	89.5%	56.3%
4.C Grasland	CO_2	37 102	9 139	-75.4%	209.6%	24.0%
4.C Grasland	CH_4	4 024	3 219	-20.0%	188.5%	17.0%
4.C Grasland	N_2O	660	334	-49.4%	84.0%	30.9%
4.D Wetlands	CO_2	9 789	11 145	13.8%	67.2%	13.7%
4.D Wetlands	CH_4	7 811	7 809	0.0%	66.9%	0.6%
4.D Wetlands	N_2O	134	152	13.6%	77.1%	31.7%
4.E Settlements	CO_2	21 438	30 495	42.2%	41.0%	16.4%
4.E Settlements	CH_4	84	144	71.8%	51.6%	45.0%
4.E Settlements	N_2O	2 228	3 649	63.8%	95.4%	62.6%
4.F Other Land	CO_2	1 181	1 045	-11.6%	60.1%	21.6%
4.F Other Land	CH_4	0	0	-41.5%	100.0%	41.5%
4.F Other Land	N_2O	14	21	47.5%	69.9%	67.5%
4.G Harvested wood products	CO_2	-27 873	-28 739	3.1%	38.2%	21.3%
4.G Harvested wood products	CH_4	0	0	0.0%	0.0%	0.0%
4.G Harvested wood products	N_2O	0	0	0.0%	0.0%	0.0%
4.H Other	CO_2	0	26	Inf	30.4%	Inf
4.H Other	CH_4	0	244	Inf	100.0%	Inf
4.H Other	N_2O	0	0	0.0%	0.0%	0.0%
4.I	CO_2	0	0	0.0%	0.0%	0.0%
4.I	CH_4	0	0	0.0%	0.0%	0.0%
4.I	N_2O	31	61	95.6%	21.5%	20.5%
4.II	CO_2	1 083	1 704	57.4%	19.0%	24.6%
4.II	CH_4	2 775	2 201	-20.7%	78.5%	42.8%
4.II	N_2O	1 965	2 223	13.2%	101.1%	19.7%
4.III	CO_2	0	0	0.0%	0.0%	0.0%
4.III	CH_4	0	0	0.0%	0.0%	0.0%
4.III	N_2O	0	0	0.0%	0.0%	0.0%
4.IV	CO_2	38	91	137.5%	37.2%	59.3%
4.IV	CH_4	33	13	-62.1%	67.4%	68.3%
4.IV	N_2O	6	3	-47.6%	34.8%	34.4%
4. Indirect emissions (4.I & 4.III)	CO_2	0	0	0.0%	0.0%	0.0%
4. Indirect emissions (4.I & 4.III)	CH_4	0	0	0.0%	0.0%	0.0%
4. Indirect emissions (4.I & 4.III)	N_2O	312	222	-28.8%	57.8%	16.7%

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
4 (where no subsector data were submitted)	*all*	*-18 556*	*-13 114*	*-29.3%*	*51.1%*	*39.6%*
Total - 4	**all**	**-237 323**	**-198 421**	**-16.4%**	**46.8%**	**121.1%**

6.6 Category -specific quality assurance and quality control, and verification

6.6.1 Quality Assurance and Quality Control

Information submitted under the LULUCF sector by EU MS is under a double QA/QC system. One implemented at country level, and another one, carried out in the context of the EU Regulations No 2018/841 and 2018/842. As LULUCF is concerned the QAQC checks are performed by the European Environment Agency, in collaboration with the countries, and European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/CM)

Under these Regulations, the checks focus on early versions of national GHG inventories that are submitted by member States to the European Commission by 15th January. The checks aim to assess and improve the completeness and consistency, but also the accuracy, transparency, and to the extent possible the comparability of the inventories. A second round of submissions are received in March, which are also checked in terms of the implementation status of issues previously identified during the QA&QC check phase. The reasons for potential recalculations of the information submitted in January and March are also assessed.

Ultimately, the checks are mainly, but not only, intended to (i) identify and resolve calculation errors, (ii) to provide suggestions to address completeness issues, (iii) to identify the need for further information to amend the lack of transparency, (iv) to spot outliers on time-series that hamper the consistency, and, (v) to identify discrepancies among data included on the different sections of the submission. In all cases, QA/QC checks are implemented by interacting with national experts to get clarifications and to plan possible improvements.

As a result of the implementation of these QA/QC checks on LULUCF information, on average around 200 observations (i.e., potential issues) are communicated to the countries. Examples of issues include the use, and justifications of notations keys, potential inconsistencies in land representation, wrong reading of how to fill in the tables, inconsistent reporting of activity data among CRT tables, and between CRT tables and NIR, outliers in IEFs values for different categories, or lack of transparency in specific national circumstances that affected the EU trend.

6.6.2 Verification

Relatively little information on verification is included in national GHG inventories. From the EEA side, as part of the implementation of QAQC checks and verification procedures, the information on biomass burning included in CRT tables 4 (IV) will be verified against data submitted, and estimated, as part of the EFFIS - European Forest Fire Information System[43].

In addition, information included in the FAOSTAT database, regarding harvested wood products, was also used to track the path of the carbon, and to assess consistency of the reporting across pools, whenever significant natural disturbances, causing important losses in the living biomass pools, were reported by member States (e.g. the impact of a windstorm in 1990 in Germany)

[43] EFFIS - Welcome to EFFIS

As regards activity data, the EEA is assessing how the information included in the LULUCF Instance – a Copernicus[44] product, including estimation of land use area, can be used to support the verification of the areas and trends of the land use categories reported by member States under the LULUCF chapter.

6.7 Category specific recalculations

Quantitative information on recalculations that impact the EU LULUCF trend is provided with more detail on chapter 10. However, this section includes an overview of the main drivers for the recalculations observed at EU level on the LULUCF trend.

In overall, recalculations introduced in the LULUCF data reflect the efforts devoted by individual countries to improve their submission of LULUCF chapter. As such, often the recalculations result from the need to incorporate in the estimations new data that become available and contribute towards moving the reporting to higher tiers.

On this regard, significant recalculations have been identified for Italy, France, Sweden and Germany. Recalculations relate to different causes and affect different land use categories and years. The text below is intended to provide a summary, (non-exhaustive list) of the main reasons for these recalculations. The information is collected from individual submission by member States.

Italy, explained that new available information “from NFI2025 and CFI2020 affected the interpolation of 2016-2019 and 2021-2022 area data of Forest and of Other Wooded Land resulting in a consequent recalculation carried out in 2025 submission”

In the case of France, the recalculations seem to be related with the efforts devoted to incorporating in the activity data acquisition process, geographically explicit information. But also, with a reassessment of the deforestation dynamics.

In the case of Sweden, the living biomass pool has been recalculated for the period 2019-2022 due to new NFI data. More sample plots also led to a recalculation of the full times series for dead wood, litter and soil organic carbon.

By last, the recalculations introduced by Germany, which are well visible in the EU LULUCF trend, affect “the entire reporting period from 1990 to 2023. The recalculation of emissions was due to new and improved data sources, methodological changes, and error corrections as part of the inventory improvement process”.

Specifically, as described in the NID of Germany (section 6.4.5, 6.5.5 and 6.6.5) the recalculations result from “the incorporation of the results from the 2022 Federal Forest Inventory (BWI) and modifications to the input data for the computer-aided modelling with YASSO15 to calculate emissions from mineral soils. The largest differences in emissions between the current submission and the 2023 submission are due to forest damage caused by drought, heat, and beetle damage since 2018.” Also the first-time recording of the emissions from the mineral soils category and modifications regarding the calculation of the perennial biomass of hedges, field trees, terrestrial wetlands and settlements result in recalculations.

6.8 Category-specific planned improvement

As part of the second EU GHG inventory submission under the Paris Agreement, efforts are ongoing to ensuring compliance with reporting requirements, and to align the LULUCF chapter to the outline included in the UNFCCC Decision 5/CMA.3

[44] CLC+: a new generation Land Information System for Europe — Copernicus Land Monitoring Service

On this regard, the recommendations received from the UNFCCC Expert Review Team, as part of the review process that the EU GHG inventory submission underwent in 2024 is being taken into consideration.

The list below shows in a non-exhausted mode the most relevant planned improvements that concern the LULUCF information.

Streamline the text in this chapter in order to facilitate an easier annual updating of the information.

Work towards a full reception by MS on the information used on Tier methods at the level of single pools, and land use subcategory.

Assess the possibility of identifying LULUCF key categories by relevant carbon pool and subcategory in accordance with the 2006 IPCC Guidelines.

7 WASTE (CRT SECTOR 5)

This chapter starts with an overview on emission trends in CRT sector 5 Waste and covers greenhouse gas emissions, which are generated from the treatment and disposal of liquid and solid waste. This sector covers the following sub-sectors:

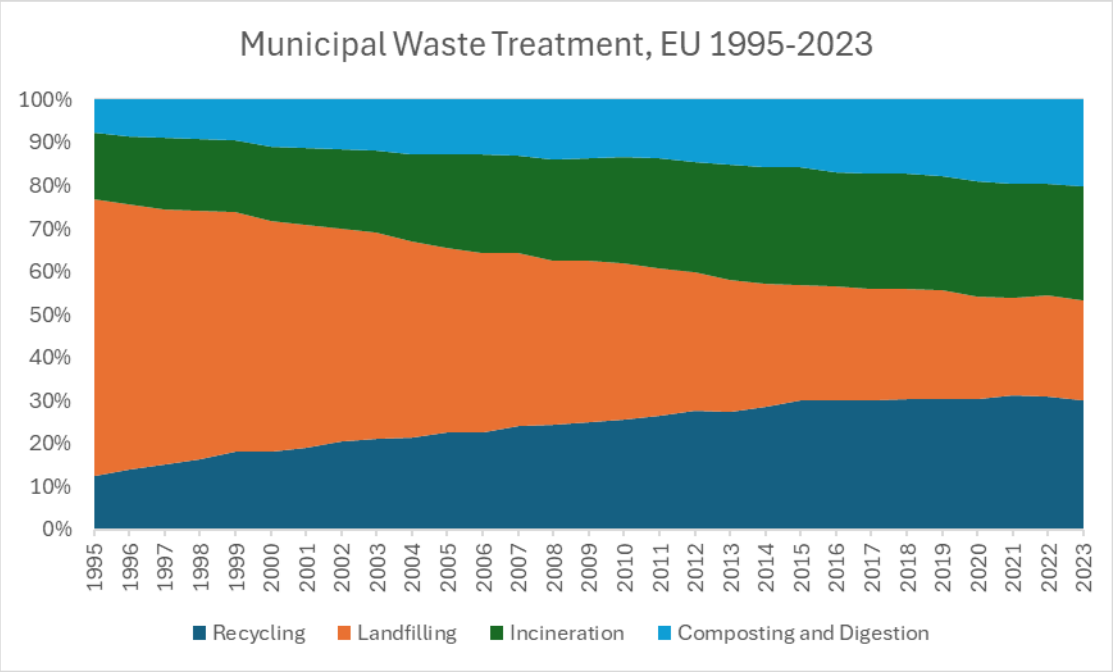
- 5.A Solid waste disposal
- 5.B Biological treatment of solid waste
- 5.C Incineration and open burning of waste
- 5.D Wastewater treatment and discharge.

For each Union key category, overview tables are presented including the Member States' contributions to the key categories in terms of level and trend, and information on methodologies and emission factors.

Of the above, the first three categories mainly refer to possible routes for treatment and disposal of solid waste. The decrease of total GHG emissions in the waste sector is mainly driven by the development of the different waste treatment routes. Figure 7.1 shows the share of the Municipal Solid Waste (MSW) treatments over the time series 1995 to 2023 based on activity data for municipal solid waste as published by Eurostat [[env_wasmun__custom_14030714]. The figure is based on Eurostat data as there is a common definition for the reporting of municipal waste to Eurostat and information on waste recycling is also included. On the basis of the Regulation on waste statistics (EC) No. 2150/2002, amended by Commission Regulation (EU) No. 849/2010, data on the generation and treatment of waste is collected from the Member States. The information on waste treatment reported to Eurostat is broken down to five treatment types (recovery, incineration with energy recovery, other incineration, disposal on land, biological treatment) and in waste categories. Eurostat data shown in the figures below include only information for municipal waste treatment, while in the GHG inventory also industrial waste, sludge and hazardous waste are reported by some countries under the categories solid waste disposal, biological treatment and waste incineration. However, the Eurostat data is used to show the overall trend of waste treatment in the European Union.

Between 1995 and 2023 the amount of municipal solid waste landfilled is continuously decreasing in the 27 EU countries and other waste treatment methods like recycling, biological treatment of waste and waste incineration with energy recovery are applied more.

Figure 7.1 Sector 5 Waste: Development of municipal waste treatment in the EU (Data source: Eurostat)



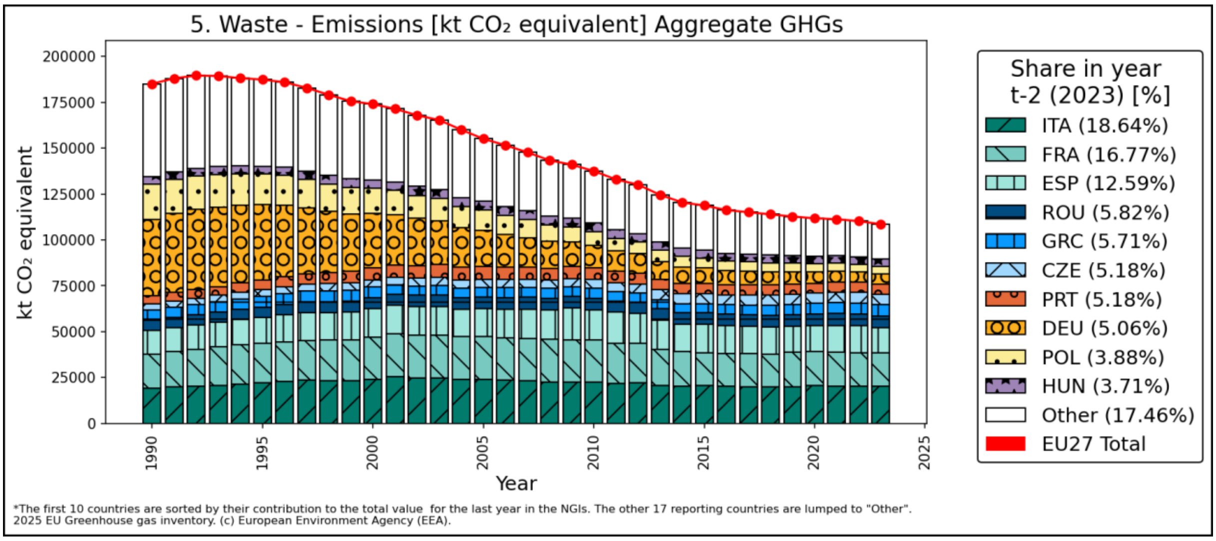
Many countries experienced a reduction of waste landfilled and an increase of recycling, composting and waste incineration with energy recovery. These trends have already started before the Landfill Directive 1999/31/EC and the Directive on packaging waste 94/62/EC and 2008/98/EC, but are further supported by these directives.

7.1 Overview of sector

Sector 5 Waste is the fourth largest sector in the EU, after energy, agriculture and industrial processes, contributing 3.7 % to total GHG emissions including indirect CO_2 and LULUCF in 2023.

Total emissions from waste decreased by 41 % from 185 Mt in 1990 to 109 Mt in 2023 (Table 7.1). This strong decrease of emissions from the waste sector is mainly influenced by a strong decline of emissions in the waste sector from Germany, Poland and the Netherlands. Reductions from category 5.A solid waste disposal on land make up about 68 % of total emission reductions in the waste sector between 1990 and 2023 (Table 7.1). Emissions from the waste sector show a continuously decreasing trend during the last years, but as many countries with large emissions from this sector already decreased emissions since 1990 by more than 70 % and most technical mitigation options are implemented in those big countries, the declining emission trend is slowing down.

Figure 7.2 Sector 5 Waste: EU GHG emissions, 1990-2023



Note:Due to an error in the aggregation of the waste subcategories in the Cypriot inventory, the sum of all Member States for 2019-2023 does not exactly add up to the EU-27 value. While the EU sum is correct it is approximately 400 kt CO_2 equivalent higher than the sum of Member States. This issue only affects the sector total and is not relevant for the subcategories.

Table 7.1 shows that CH_4 emissions from 5A1 Managed Waste Disposal on Land had the greatest decrease of all waste-related emissions (- 36 %) between 1990 and 2023 but still accounts for 60 % of waste-related GHG emissions in the EU in 2023.

Table 7.1 Sector 5 Waste: Share of major source categories and all remaining categories in 2023 for EU

GREENHOUSE GAS SOURCE CATEGORIES	1990 (kt)	2023 (kt)	absolute change (Mt)	% change (in Mt)	share 2023
5.A.1 - Managed Waste Disposal Sites - CH4	102025	65327	-37	-36%	60%
5.D.2 - Industrial Wastewater - CH4	9601	5431	-4	-43%	5%
5.A.2 - Unmanaged Waste Disposal Sites - CH4	30221	8554	-22	-72%	8%
5.D.1 - Domestic Wastewater - CH4	26758	10523	-16	-61%	10%
5.D.1 - Domestic Wastewater - N2O	6739	8774	2	30%	8%
5.B.1 Waste Composting: Waste (CH4)	513	2785	2	443%	3%
5.B.1 Waste Composting: Waste (N2O)	306	1734	1	466%	2%
All other waste categories	8841	5758	-3	-35%	5%
Total Waste	**185004**	**108885**	**-76**	**-41%**	**100%**

Note: Colors visualize decreases (green), increases (red) and the share in sectoral total emissions (yellow). "Other" is calculated by subtracting the presented categories from the sector total.

7.2 Overview of trends in sector

In this section the contribution of the different emission categories to the overall trend of emissions from the EU waste sector is analysed. Table 7.2 shows the overview of the trend for the waste sector per emission categories. For the whole sector, there was a decrease of 41 % between 1990 and 2023, resulting mainly of the decrease of emission in sector 5.A Solid waste disposal. There was a slight decrease of emissions between 2022 and 2023 (-1.5%).

Table 7.2 Sector 5 Waste: Overview of trend of the sector in 2023 for EU

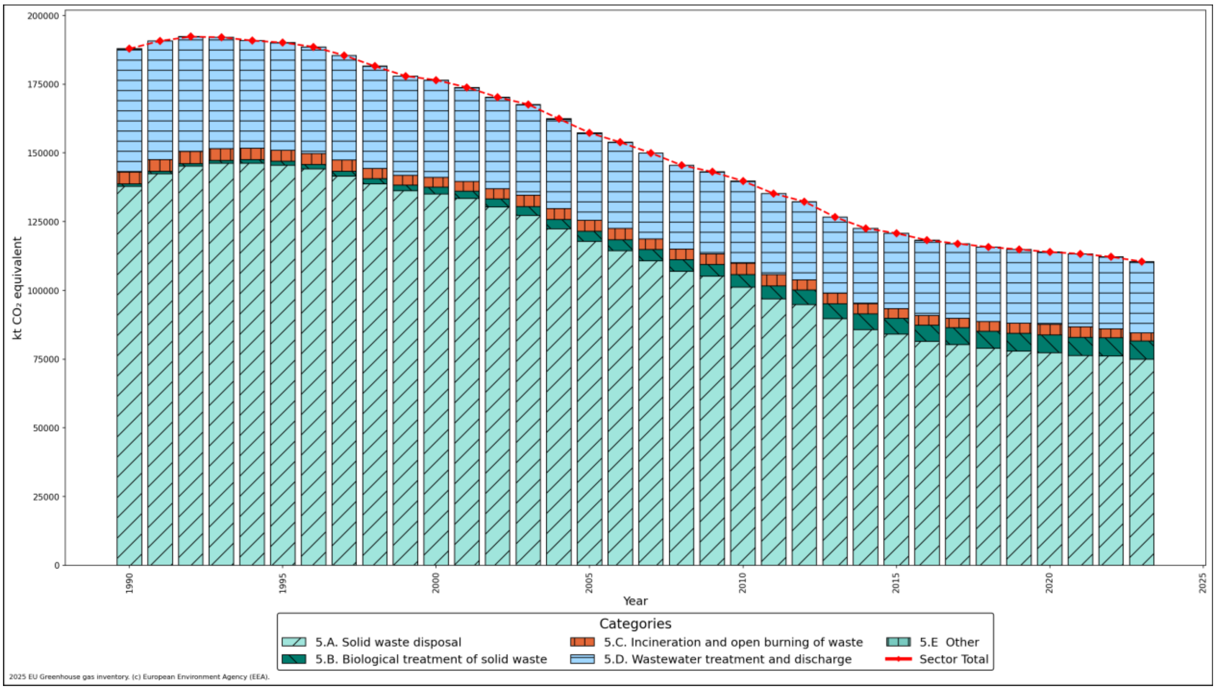


Table 7.3 shows the different emission categories, their contribution to total emissions in the EU sector and their contribution to the trend 1990-2023 and 2021-2023. A negative share of the trend means that the emissions in that category are evolving in the opposite direction to those of the EU.

Table 7.3 Contribution of the different emission categories to the total trend in emissions from the waste sector

Emission category	Gas	Contribution to total waste emissions (2023)	Change in trend 1990-2023	Change in trend 2022-2023
5.A	CH_4	68%	-45%	-2%
5.B	CH_4	4%	813%	2%
5.B	N_2O	2%	497%	0%
5.C	CH_4	0%	-10%	-1%
5.C	CO_2	2%	-41%	-12%
5.C	N_2O	0%	-24%	0%
5.D	CH_4	15%	-56%	-2%
5.D	N_2O	9%	21%	0%
5.E	CH_4	0%	-99%	0%
5.E	CH_4	0%	-85%	-6%
5.E	CH_4	0%	-22%	-8%
5.E	CO_2	0%	-27%	-19%
5.E	CO_2	0%	-27%	-19%
5.E	N_2O	0%	NA	-5%
5.E	N_2O	0%	NA	-5%

The main contributor to the total decrease in waste emissions from last year is category 5.A.1, followed by 5.A.2) and 5.D.2. The contribution of the other categories is approximately 10 % of total change.

7.3 Source categories and methodological issues

The most important GHG from this sector is CH_4 (88 % of total GHG emissions), followed by N_2O (11 % of total GHG emissions). GHG emissions arising from waste incineration with energy recovery are allocated in category 1A1, as well as emissions from the combustion with energy recovery of the biogas produced in landfills, waste digesters and sludge digesters. CO_2 generated by the combustion or the decomposition of organic waste or from biogas combustion is not accounted for in the national total.

Table 7.1 shows the key categories on an aggregated level, visualising, that CH_4 emissions from 5A1 – Managed Waste Disposal Sites had the highest share in 2023, and is the category showing the highest decrease since 1990. N_2O emissions have a rather small share but have been increasing in the last year as composting of waste is increasingly used as a way of treating waste.

The following chapters include information on emission levels and emission trends for all 27 countries (EU) for the EU key source categories and composting. Additionally, information for EU key source categories on national methods and circumstances, which are available in the countries' national inventory reports, are provided in the Annex III.

The following table lists the key sources in the waste sector, and share of Member States using a higher Tier method to estimate these emissions. The share of higher Tier corresponds to the share of EU emissions documented by countries reporting the method as an IPCC Tier 2 method (T2) or a country-specific method (CS), or countries reporting EF as country-specific (CS) or plant specific (PS).

Almost all countries report CH_4 emissions from solid waste disposal on managed and unmanaged landfills 5.A using a Tier 2 methodology. In all other source categories in the waste sector the share of countries using a higher Tier method is much lower.

Table 7.4 Key source categories for level and/or trend analyses and share of MS emissions using higher tier methods

Source category gas	kt CO_2 eq.		Trend	Level		share of higher Tier
	1990	2023		1990	2023	
5.A.1. Managed waste disposal sites: no classification (CH_4)	102025	65327	0	L	L	100%
5.A.2. Unmanaged waste disposal sites: no classification (CH_4)	30221	8554	T	L	L	100%
5.D.1. Domestic wastewater: no classification (CH_4)	26758	10523	T	L	L	63%
5.D.1. Domestic wastewater: no classification (N_2O)	6739	8774	T	0	L	32%
5.D.2. Industrial wastewater: no classification (CH_4)	9601	5431	0	L	L	39%

Note: For 5.A.1/CH_4 : 2MSs (NLD and CYP) do not document the Tier level; For 5.A.2/CH_4: 2 MSs (PRT and ESP) do not document the Tier level;

For other source categories in the waste sector that are not identified as key sources, only information on total emissions is provided in chapter 3.6.8).

7.3.1 Solid waste disposal on land (CRT Source Category 5A)

Methane is produced from anaerobic microbial decomposition of organic matter in solid waste disposal sites. This source category includes two key categories: CH_4 from 5A1 Managed waste disposal on land and CH_4 from 5.A.2 Unmanaged waste disposal on land. In addition, source category 5A includes the category 5.A.3 CH_4 emissions from uncategorized landfills, but only Estonia (1990-1993) and Poland (1990-2022) report emissions from this category. As this is no EU key category no further information on 5.A.3 is included in the following chapters.

The source category 5A contributes 2.5 % to total GHG emissions including indirect CO_2 and with LULUCF, in 2023.

Table 7.5 provides total greenhouse gas and CH_4 emissions by Member State from 5A Solid Waste Disposal on Land. CH_4 emissions from this category decreased by 45 % between 1990 and 2023 in the EU. Fourteen EU countries reduced their emissions from this source. In the countries experiencing an increase, waste disposal changed from unmanaged to managed landfills during the time period 1990 and 2023 which leads to increasing CH_4 emissions from managed landfills. In 2023, CH_4 emissions from landfills decreased by 1.5 % compared to 2022.

Table 7.5 5A Solid Waste Disposal on Land: Countries contributions to total GHG emissions and CH_4 emissions

Member State	GHG emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023
Austria	4 081	799	4 081	799
Belgium	3 323	512	3 323	512
Bulgaria	2 100	2 101	2 100	2 101
Croatia	555	1 364	555	1 364
Cyprus	295	579	295	579
Czechia	2 008	3 814	2 008	3 814
Denmark	1 525	400	1 525	400
Estonia	239	183	239	183
Finland	4 847	1 326	4 847	1 326
France	12 457	11 667	12 457	11 667
Germany	37 191	2 245	37 191	2 245
Greece	2 512	4 470	2 512	4 470
Hungary	2 977	3 282	2 977	3 282
Ireland	1 476	594	1 476	594
Italy	13 671	15 677	13 671	15 677
Latvia	353	397	353	397
Lithuania	1 152	563	1 152	563
Luxembourg	103	47	103	47
Malta	46	165	46	165
Netherlands	15 321	1 910	15 321	1 910
Poland	13 448	931	13 448	931
Portugal	2 945	4 079	2 945	4 079
Romania	1 536	4 407	1 536	4 407
Slovakia	782	1 163	782	1 163
Slovenia	418	172	418	172
Spain	6 131	10 607	6 131	10 607
Sweden	3 847	471	3 847	471
EU-27	**135 338**	**73 924**	**135 338**	**73 924**

Note: The first two columns show total emissions from 5A reported in kt CO_2 eq. The last two columns show CH_4 emissions in kt CO_2 eq. As only CH_4 emissions are reported under 5.A the figures in the columns are identical. Abbreviations explained in the Chapter 'Units and abbreviations.

7.3.1.1 Managed waste disposal sites (CRT Source Category 5A1)

Table 7.6 provides information on emission trends of the key source CH_4 from 5A1 Managed Waste Disposal on Land by Member State. CH_4 emissions from this source account for 2.2 % of total EU GHG emissions including indirect CO_2, with LULUCF, in 2023. Between 1990 and 2023, CH_4 emissions from managed landfills declined by 36 % in the EU. In 2023, CH_4 emissions from managed landfills decreased by 1.0 % compared to 2022.

Table 7.6 5A1 Managed Waste Disposal on Land: Countries contributions to CH_4 emissions and information on method applied and emission factor

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	4 081	846	799	1.2%	-3 282	-80%	-46	-5%	NA,T2	CS,D,NA
Belgium	3 323	557	512	0.8%	-2 812	-85%	-45	-8%	NA,T2	D,NA
Bulgaria	NO	1 238	1 249	1.9%	1 249	∞	10	1%	NA,T2	CS,D,NA
Croatia	525	1 383	1 364	2.1%	839	160%	-18	-1%	NA,T2	CS,NA
Cyprus	NO	181	202	0.3%	202	∞	21	12%	NA	NA
Czechia	2 008	3 774	3 814	5.8%	1 806	90%	40	1%	NA,T1	D,NA
Denmark	1 525	410	400	0.6%	-1 125	-74%	-10	-2%	CS,NA,T2	CS,D,NA
Estonia	NO	190	183	0.3%	183	∞	-7	-4%	NA,T2	D,NA
Finland	4 847	1 384	1 326	2.0%	-3 521	-73%	-58	-4%	NA,T2	CS,D,NA
France	12 457	11 462	11 667	17.9%	-790	-6%	205	2%	T2	CS,D
Germany	37 191	2 432	2 245	3.4%	-34 946	-94%	-187	-8%	NA,T2	CS,NA
Greece	90	3 091	3 115	4.8%	3 025	3376%	24	1%	NA,T2	CS,D,NA
Hungary	470	2 178	2 190	3.4%	1 721	366%	13	1%	NA,T2	D,NA
Ireland	NO	634	594	0.9%	594	∞	-40	-6%	M,NA,T2	CS,D,M,NA
Italy	7 153	13 598	13 799	21.1%	6 646	93%	200	1%	NA,T2	CS,NA
Latvia	NO	293	295	0.5%	295	∞	2	1%	NA,T2	D,NA
Lithuania	766	457	454	0.7%	-312	-41%	-2	-1%	NA,T2	D,NA
Luxembourg	103	49	47	0.1%	-56	-54%	-2	-3%	NA,T1	D,NA
Malta	NO	163	160	0.2%	160	∞	-3	-2%	NA,T2	M,NA
Netherlands	15 321	2 027	1 910	2.9%	-13 411	-88%	-118	-6%	NA	NA
Poland	1 483	773	868	1.3%	-616	-42%	95	12%	NA,T2	CS,D,NA
Portugal	793	3 537	3 529	5.4%	2 736	345%	-8	0%	T2	CS,D
Romania	NA,NO	2 658	2 762	4.2%	2 762	∞	105	4%	NA,T2	CS,D,NA
Slovakia	782	1 200	1 163	1.8%	381	49%	-37	-3%	NA,T2	CS,NA
Slovenia	418	176	172	0.3%	-246	-59%	-4	-2%	NA,T2	CS,D,NA
Spain	4 843	10 812	10 037	15.4%	5 194	107%	-775	-7%	NA,T2	CS,D,NA,OTH
Sweden	3 847	511	471	0.7%	-3 376	-88%	-40	-8%	T2	CS,D
EU-27	**102 025**	**66 013**	**65 327**	**100%**	**-36 698**	**-36%**	**-686**	**-1%**	**-**	**-**

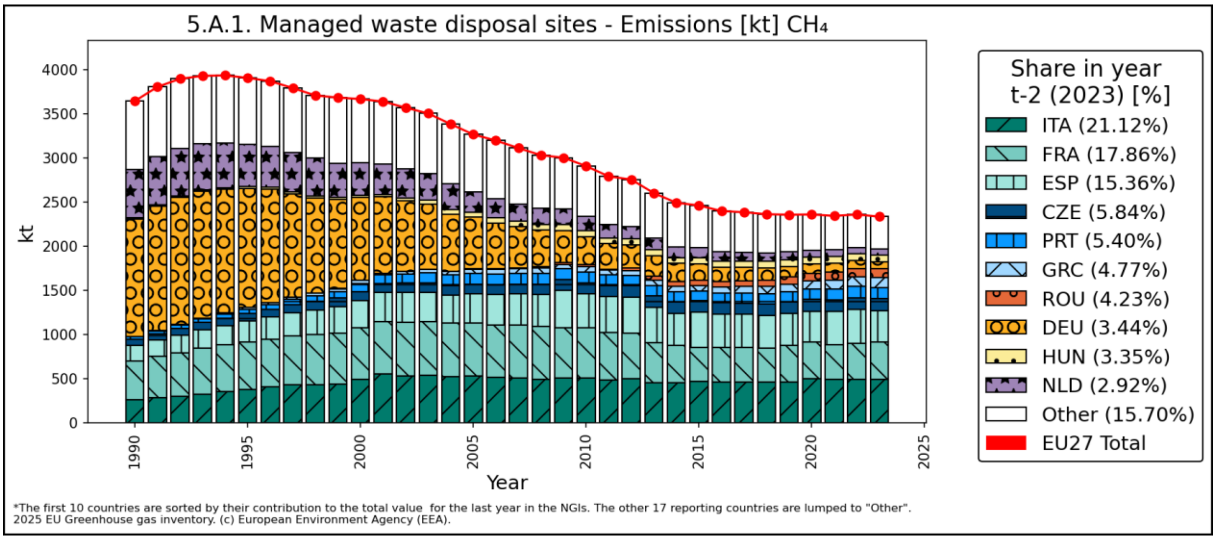
Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Trends in Emissions and Activity Data

CH_4 emissions from solid waste disposal on managed land decreased considerably between 1990 and 2023 by 36 %. *Figure 7.3* shows the trend of emissions indicating the countries contributing most to EU total.

The countries with highest emissions from this source in 2023 were Italy, France and Spain. These MS account for 54.3 % of EU CH_4 emissions from 5A1. The largest reductions in absolute terms between 1990 and 2023 were reported by Germany. The emission reductions are partly due to the (early) implementation of the landfill waste directive or similar legislation in these countries. The landfill waste directive was adopted in 1999 and requires the Member States to reduce the amount of biodegradable waste disposed untreated to landfills and to install landfill gas recovery at all new sites.

Figure 7.3 5A1 Managed waste disposal on land: CH_4 emissions (Trend in relevant countries)



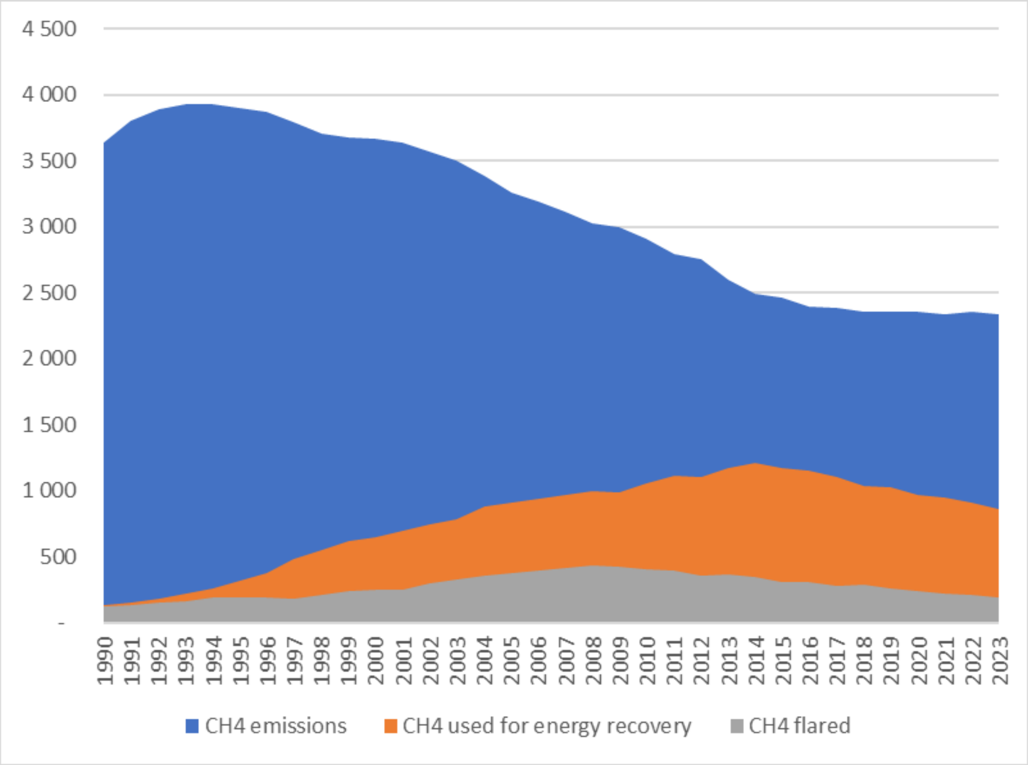
A main driving force of CH_4 emissions from managed waste disposal on land is the amount of waste, especially of biodegradable waste going to landfills. In addition, CH_4 emissions from landfills are influenced by the amount of CH_4 recovered and utilized or flared. The share of CH_4 recovery has increased significantly in EU since 1990.

Methane recovery and flaring

Besides lower quantities of organic carbon deposited on landfills, the major determining factor for the decrease in net CH_4 emissions are increasing methane recovery rates from landfills and flaring of CH_4.

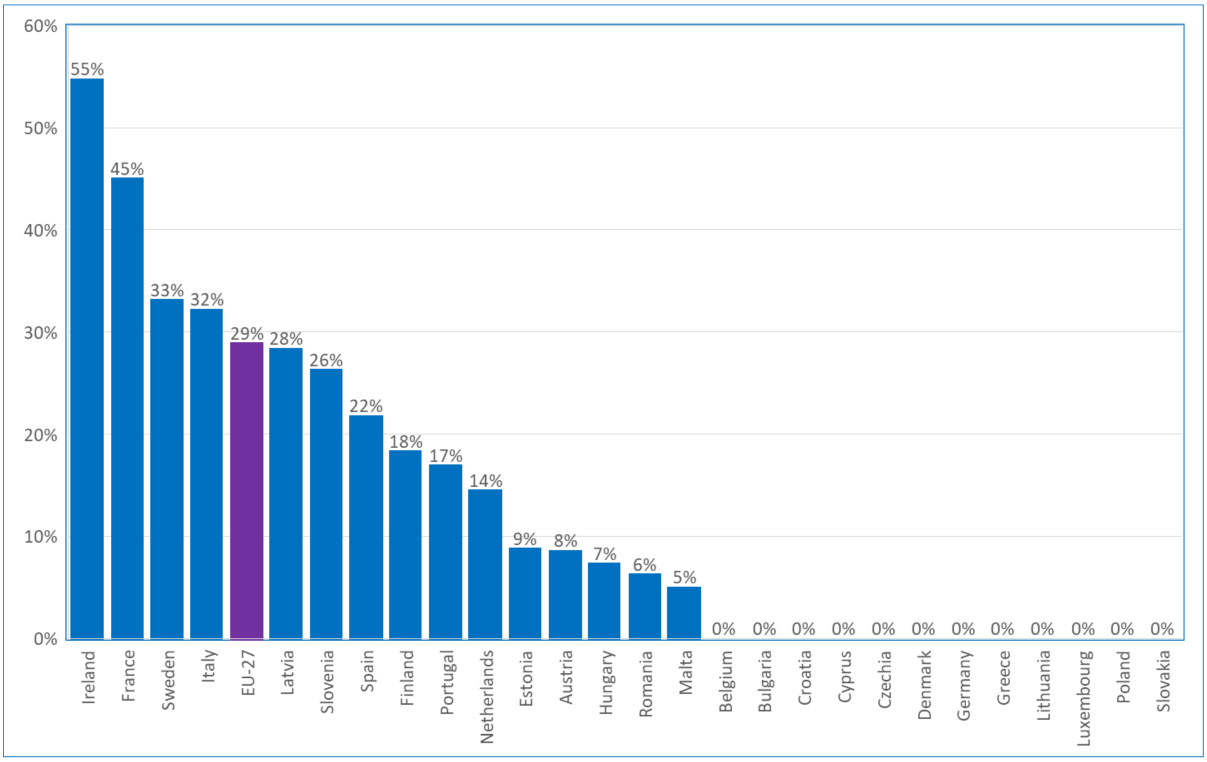
CH_4 recovery and flaring of CH_4 in EU increased from 6% of the total amount of CH_4 generated ("generated" = CH_4 emitted / (1-Ox) + CH_4 flared + CH_4 recovered where the oxidation factor Ox = 0.9) in managed landfills (only 5A1) in 1990 to 29 % in 2023 (Figure 1.4). Methane recovery is further promoted by the Landfill Directive, and monitoring programs are established. The recovery potential depends on the waste management strategies, e.g. diverting organic fractions to composting leaves more inert materials on landfills and reduces the potential to recover and use CH_4.

Figure 7.4 5A1 Managed Solid Waste Disposal: Evolution of the share of methane used for energy recovery, methane flared and CH_4 emissions in managed landfills in the EU



Source: CRT 2025, Table 5A

Figure 7.5 5A1 Managed Solid Waste Disposal: Share of methane recovery ratio per MS in 2023



The recovered CH_4 is the amount of CH_4 that is captured for energy use and is a country-specific value which has significant influence on the emission level. Additionally, the amount of CH_4 flared is considered. The percentage of CH_4 recovered and flared, in Figure 7.5, varies among the countries and depends - amongst other - on the share of solid waste disposal sites where recovery installations exist.

Methodological issues

For key sources in the source category 5A it is good practice to use the First Order Decay (FOD) method to calculate the emissions and to display emission trends over time. Giving the IPCC 2006 Guidelines for National Greenhouse Gas Inventories, the First Order Decay (FOD) method that accounts for the fact that the degradable organic components decay slowly over decades, has to be applied for all Tier levels. The Tier 1 method applies mainly default parameters and default activity data. The Tier 2 FOD method requires data on current as well as historic waste quantities, composition and disposal practices for several decades. Historical waste disposal data for 30 years or more should be based on country-specific statistics, surveys or other similar sources. In the following, a short overview of the most important parameters and methodological aspects of the FOD method is presented. The main factors influencing the quantity of CH_4 produced are the amount of waste disposed on land and the concentration of biodegradable carbon in that waste. Further methodological information for all EU countries is provided in the Annex III of this submission.

Municipal Waste landfilled

The amount of waste disposed on SWDS depends on the total amount of waste generated and the share of waste disposed. The total amount of waste disposed can be calculated by using total population numbers, waste generation rate per capita and the share of waste disposed. The FOD method requires historic data on waste generation and the share of waste landfilled over decades, but it is difficult to achieve consistent time series for the activity data over such long periods.

Recent data on waste generation and waste disposal is available in most EU countries and is not estimated based on the per capita waste generation rate and a share of waste landfilled, but on direct measurements. Countries that do not have historic data on waste generation and waste disposal available use the default IPCC values for the waste generation rate per capita and the share of waste disposed and apply inter- or extrapolation methods to create a time series.

Industrial waste

Data on industrial waste may be difficult to obtain in many countries and there are only very few default values available. Only industrial waste that contains organic or fossil carbon fractions needs to be included in the inventory. Many countries do not provide any information on industrial waste landfilled, while other countries report that industrial waste is not reported separately and included under municipal solid waste.

Sludge

Double counting needs to be avoided by reporting a consistent amount of sludge that is disposed of on SWDS; only sludge that goes along with solid waste has to be accounted under this category. All other sludge that is composted, incinerated, treated in wastewater plants or applied to agricultural land should be accounted under other categories. There is no IPCC default activity data available. If no country-specific activity data is available on the amount of sludge that is disposed, composted, incinerated or spread on agricultural land, all emissions from sludge are included under wastewater treatment.

Waste composition

The amount of methane generated on SWDS depends strongly on the waste composition. Disposing waste with no or hardly degradable carbon (e.g. metal or plastics) does not contribute to CH_4 emissions, but the disposal of paper or food waste with large degradable organic carbon fractions leads to high CH_4 emissions. The composition of the waste landfilled is strongly influenced by waste management practices, such as recycling or composting. This leads also to varying waste compositions along the time series.

Landfill gas recovery

Countries use different methods to determine CH_4 recovery. Several countries combine different methods and sources to estimate the amounts of CH_4 recovered for flaring or for energy purposes, while other countries are using only one method. Data on landfill gas recovery can be based on measured plant specific data, questionnaires and surveys or can be taken from the energy statistics. Further information on CH_4 recovery in the country is provided in the Annex III of this submission.

Emission factors and parameters

Besides information on the amount of waste landfilled, the waste composition and the amounts of CH_4 recovered, other parameters are relevant for the calculation of CH_4 emissions from waste disposal. The fraction of degradable organic carbon (DOC) dissimilated in the individual waste fractions and the methane generation rate constant, which reflects the years necessary for the degradable organic carbon to decompose, are the most relevant parameters for calculating CH_4 emissions. Further parameters included in the calculation are the methane correction factor (MCF), the fraction of DOC that decomposes, the fraction of CH_4 in generated landfill gas and the oxidation factor.

Fraction of Degradable Organic Carbon (DOC): There are default IPCC values for DOC of the different waste fractions available (paper, food waste etc.). Some countries have conducted own chemical analysis to determine the DOC value of different waste fractions. The DOC content of total landfilled waste is based on the composition of waste and can be calculated from a weighted average of the carbon content of various components of the waste. Countries have MSW with widely differing waste compositions.

Methane generation rate constant: CH_4 is emitted on SWDS over a long period of time rather than instantaneously. The FOD model can be used to model landfill gas generation rate curves for individual landfills over time. One important parameter is the methane generation rate constant (also referred to as k-value or half-life value). It is determined by a large number of factors associated with the composition of waste and the conditions at the site.

7.3.1.2 Unmanaged waste disposal sites (CRT Source Category 5A2)

CH_4 emissions from 5A2 Unmanaged Waste Disposal on Land account for 0.3 % of total EU GHG emissions including indirect CO_2, with LULUCF, in 2023. Almost all countries with unmanaged waste disposal feature a decreasing emission trend, due to a decreasing amount of municipal waste going to unmanaged waste disposal sites.

Table 7.7 5A2 Unmanaged Waste Disposal on Land: Countries contributions to CH_4 emissions and information on method applied and emission factor

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	NO	NO	NO	-	-	-	-	-	NA	NA
Belgium	NO	NO	NO	-	-	-	-	-	NA	NA
Bulgaria	2 100	924	852	10.0%	-1 247	-59%	-72	-8%	T2	CS,D
Croatia	30	NO	NO	-	-30	-100%	-	-	NA	NA
Cyprus	295	394	377	4.4%	81	28%	-17	-4%	T2	D
Czechia	NO	NO	NO	-	-	-	-	-	NA	NA
Denmark	NO	NO	NO	-	-	-	-	-	NA	NA
Estonia	NO	NO	NO	-	-	-	-	-	NA	NA
Finland	IE	NO	NO	-	-	-	-	-	NA	NA
France	NO	NO	NO	-	-	-	-	-	NA	NA
Germany	NO	NO	NO	-	-	-	-	-	NO	NO
Greece	2 423	1 410	1 355	15.8%	-1 068	-44%	-55	-4%	T2	CS,D
Hungary	2 507	1 144	1 091	12.8%	-1 416	-56%	-53	-5%	T2	D
Ireland	1 476	NO	NO	-	-1 476	-100%	-	-	NA	NA
Italy	6 518	1 963	1 878	22.0%	-4 640	-71%	-84	-4%	T2	CS
Latvia	353	111	102	1.2%	-251	-71%	-10	-9%	T2	CS,D
Lithuania	386	116	109	1.3%	-277	-72%	-7	-6%	T2	D
Luxembourg	IE	IE	IE	-	-	-	-	-	NA	NA
Malta	46	6	5	0.1%	-42	-89%	-1	-14%	M	M
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NA
Poland	9 112	23	21	0.2%	-9 091	-100%	-3	-11%	T2	CS,D
Portugal	2 152	589	549	6.4%	-1 602	-74%	-40	-7%	-	-
Romania	1 536	1 728	1 644	19.2%	108	7%	-84	-5%	T2	CS,D
Slovakia	NO	NO	NO	-	-	-	-	-	NA	NA
Slovenia	NO	NO	NO	-	-	-	-	-	NA	NA
Spain	1 288	599	570	6.7%	-718	-56%	-29	-5%	-	-
Sweden	NO	NO	NO	-	-	-	-	-	-	-
EU-27	**30 221**	**9 008**	**8 554**	**100%**	**-21 667**	**-72%**	**-454**	**-5%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Trends in Emissions and Activity Data

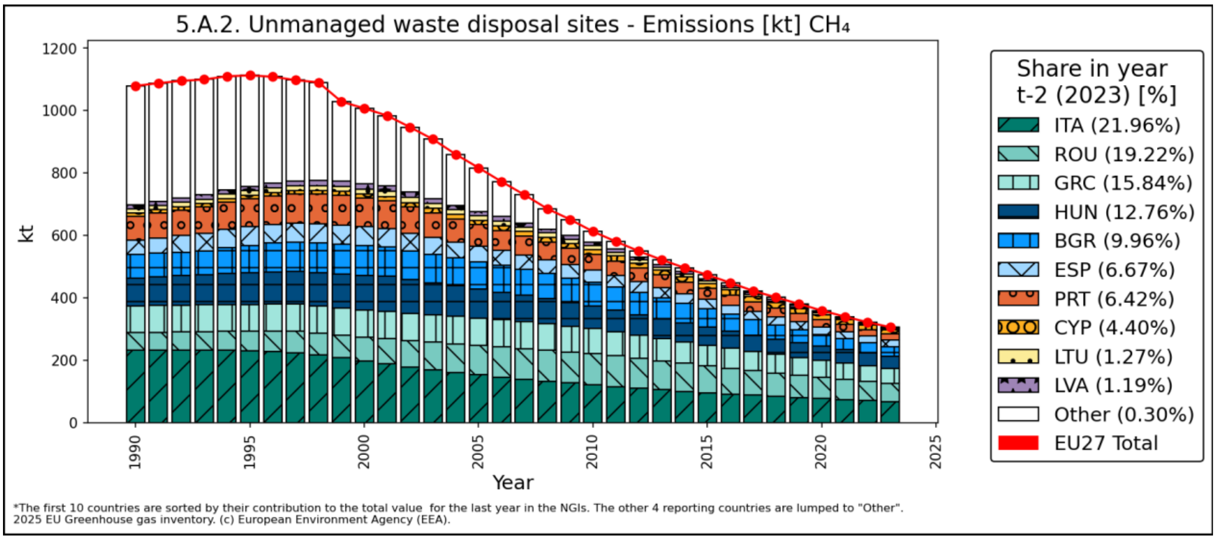
CH_4 emissions from unmanaged solid waste disposal sites decreased considerably. Between 1990 and 2023, CH_4 emissions from this source decreased by 72 % (Table 7.7). In 2023, CH_4 emissions from unmanaged landfills decreased by 5 % compared to 2022.

Figure 7.6 shows the trend of emissions indicating the countries contributing most to EU total. In comparison to the rather drastic decrease of the amount of waste disposed on unmanaged landfills (> -99,5%). CH_4 emissions from unmanaged landfills show a more limited decrease (-76%) during the 1990-2023 time series because of the FOD approach.

Not all countries reported emissions from this source since all waste disposal sites in the countries are managed) or they are included elsewhere (see Table 1.4).

Italy, Romania, Greece are responsible for about 57 % of the total EU emissions from unmanaged waste disposal sites in 2023 (see *Figure 7.6*). Poland and Italy show the larger absolute reductions between 1990 and 2023.

Figure 7.6 *5A2 Waste disposal on unmanaged landfills: CH_4 emissions (Trend in relevant countries)*



Note that, in some countries, waste disposal in unmanaged landfills was practiced but does not occur anymore. However, emissions are still produced from the waste disposed in the past. For the following countries, there are still emissions, but no more waste is disposed on the unmanaged landfills as from the year mentioned: Ireland since 1999, Italy since 2000, Hungary since 2001, Finland since 2002, Portugal and Malta since 2005, Slovakia since 2010, Poland since 2012, Latvia and Spain since 2013, Romania in 2018, Cyprus since 2019 and Lithuania since 2020 (except 2022) and Croatia (since 2022).

In the unmanaged solid waste landfills, hardly any CH_4-recovery takes place. Only Ireland (1996-1998) and Latvia (since 2002) report CH_4 recovery from unmanaged landfills for a few years in the time series.

For countries still using unmanaged landfills (Bulgaria, Greece), solid waste disposal on unmanaged landfill sites is still practiced, but the amount of waste disposed the relative decrease of waste disposed is higher than 96 % in comparison with 1990.

Methodological issues

CH_4 emissions from unmanaged solid waste disposal sites were reported in 13 EU countries in 1990. Only two of these EU countries still dispose MSW to unmanaged SWDS, although in small quantities, while in all other countries waste disposal from the past still cause emissions in 2023 (Table 7.7). 100 % of all EU emissions from this category are calculated using higher tier methods (Table 7.3).

CH_4 emissions from waste disposal on unmanaged landfills are calculated similar to CH_4 emissions from managed landfills, using the amount of waste disposed on unmanaged landfills. If no other data is available the same data on waste composition and the same parameters as used for managed landfills can be applied in the calculation. The Methane Correction Factor (MCF) is the relevant parameter that differentiates between managed and unmanaged landfills, the three countries still disposing MSW are using an MCF value of 0.8, representing deep unmanaged landfills.

7.3.2 Biological treatment of solid waste (CRT Source Category 5B)

Source category 5B Biological treatment of solid waste includes CH_4 and N_2O emissions from subcategories 5B1 Composting and 5B2 anaerobic digestion and also emissions from mechanical-biological treatment according to the IPCC 2006 Guidelines.

The whole sector 5.B contributes only 0.2 % to EU total GHG emissions including indirect CO_2, with LULUCF, in 2023 and is not a quantitative the key source for EU.

Decomposition of biomass during biological treatment is much faster than on landfills and the CH_4 emissions are estimated on an annual basis without the need for long time series as in the case of landfills. For composting the decomposition of the organic waste fraction takes place under aerobic conditions. In anaerobic digestion processes the decomposition takes place without oxygen.

Table 7.8 provides total GHG and CH_4 and N_2O emissions by Member State from 5B Biological treatment of solid waste. Total emissions from this category increased considerably since 1990 (more than 800%), and especially since 1993, due to landfill regulations. All countries report emissions from this category since 2010.

Table 7.8 5B Biological treatment of solid waste: Countries contributions to total GHG emissions and CH_4 and N_2O emissions

Member State	GHG emissions in kt CO2 equivalents		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
Austria	35	149	20	72	15	77
Belgium	6	68	4	37	3	31
Bulgaria	NO	14	NO	5	NO	9
Croatia	NO	45	NO	10	NO	34
Cyprus	NO	19	NO	7	NO	12
Czechia	NE,IE	559	IE,NE	62	IE,NE	497
Denmark	43	632	13	49	30	583
Estonia	5	28	2	10	3	18
Finland	45	89	16	27	29	62
France	173	832	61	178	112	654
Germany	79	1 085	20	192	59	893
Greece	1	123	NO	5	1	118
Hungary	9	156	3	38	6	118
Ireland	NA,NO	50	NA,NO	16	NA,NO	34
Italy	23	501	18	387	5	113
Latvia	29	61	11	19	19	43
Lithuania	0	117	0	27	0	91
Luxembourg	IE,NO	28	IE,NO	5	IE,NO	23
Malta	NO	0	NO	NA,NE,NO	NO	0
Netherlands	11	209	6	74	5	135
Poland	22	428	8	152	14	277
Portugal	9	78	3	25	6	54
Romania	NE,NO	77	NE,NO	20	NE,NO	57
Slovakia	114	312	41	103	73	209
Slovenia	NA,NO	18	NA,NO	6	NA,NO	11
Spain	209	818	76	285	133	533
Sweden	13	89	5	18	8	71
EU-27	**827**	**6 586**	**306**	**1 828**	**521**	**4 758**

Note: Abbreviations explained in the Chapter 'Units and abbreviations'

Biological treatment of waste is not a quantitative key category for the European Union but because of the rapid increase of emissions from composting activities it can be considered as a qualitative key category. Therefore, source category 5B1 Composting is presented hereafter. Regarding 5B2 Anaerobic digestion, some additional information can be found in the chapter 3.6.8 dedicated to waste - non key categories.

7.3.2.1 Waste Composting (CRT Source Category 5B1)

Emission and Trends

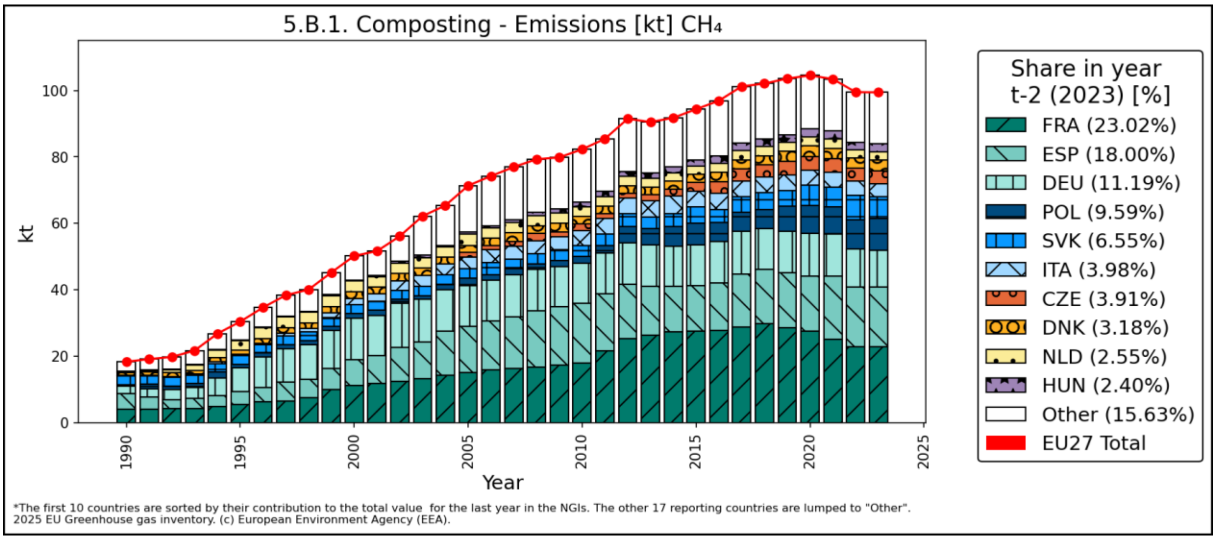
CH_4 emissions from 5B1 Composting account for 0.09 % of total EU GHG emissions including indirect CO_2, with LULUCF, in 2023. Between 1990 and 2023, CH_4 emissions from this source increased considerably of 443% (Table 7.9). All countries feature an increasing emission trend from 1990 onwards.

Table 7.9: 5B1 Waste Composting: Countries contributions to CH_4 emissions and information on method applied and emission factor

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	15	55	55	2.0%	41	279%	0	0%	NA,T2	CS,NA
Belgium	3	25	31	1.1%	28	954%	5	22%	NA,T1	CS,NA
Bulgaria	NO	8	9	0.3%	9	∞	1	6%	NA,T1	D,NA
Croatia	NO	16	18	0.7%	18	∞	2	16%	NA,T1	D,NA
Cyprus	NO	12	12	0.4%	12	∞	0	3%	T1	D
Czechia	NE	113	109	3.9%	109	∞	-4	-3%	T1	D
Denmark	24	83	89	3.2%	64	267%	5	7%	NA,T1,T2	CS,D,NA
Estonia	3	19	18	0.6%	14	456%	-2	-9%	NA,T1	D,NA
Finland	29	60	48	1.7%	19	66%	-12	-20%	T1	D
France	111	641	641	23.0%	530	475%	0	0%	T2	CS,D
Germany	59	320	312	11.2%	252	425%	-9	-3%	NO,T2	CS,NO
Greece	NO	8	8	0.3%	8	∞	0	-1%	D	D
Hungary	6	65	67	2.4%	61	1095%	2	3%	T1	D
Ireland	NA,NO	22	29	1.0%	29	∞	7	30%	NA,T1	D,NA
Italy	5	117	111	4.0%	106	2044%	-6	-5%	D,NA	CS,NA
Latvia	19	29	33	1.2%	14	75%	4	14%	D,NA	D,NA
Lithuania	0	35	47	1.7%	47	20354%	12	34%	T1	D
Luxembourg	NO	7	8	0.3%	8	∞	1	9%	T1	D
Malta	NO	NE,NO	NE,NO	-	-	-	-	-	NA	NA
Netherlands	5	69	71	2.6%	66	1384%	2	3%	NA,T1	CS,NA
Poland	14	249	267	9.6%	253	1777%	18	7%	T1	D
Portugal	6	41	43	1.6%	38	672%	3	7%	T1	D
Romania	NE,NO	36	35	1.2%	35	∞	-2	-5%	NA,T1	D,NA
Slovakia	73	205	182	6.5%	110	151%	-23	-11%	T1	D
Slovenia	NA,NO	12	11	0.4%	11	∞	-1	-6%	NA,T1	D,NA
Spain	133	501	501	18.0%	368	276%	0	0%	NA,T1	D,NA
Sweden	8	37	31	1.1%	23	289%	-6	-17%	T1	D
EU-27	**513**	**2 787**	**2 785**	**100%**	**2 272**	**443%**	**-2**	**0%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Figure 7.7 5B1 Waste Composting: CH_4 emissions (Trend in relevant countries)



Presented methods and emission factor information refer to the last inventory year.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Emissions from 5.B.1 relate with composting of municipal (5.B.1.a) and composting of other waste (5.B.1.b). Only 11 countries report emissions from other waste composting. Other countries generally report emissions from composting of all types of waste (municipal, industrial, sludge…) in the category 5.B.1.a since statistal data concerning composting generally relate to total waste and do not make a distinction between the various types of waste.

Methodological information

According to the IPCC 2006 Guidelines CH_4 from composting is estimated by using the quantity of organic waste processed by composting and the respective emission factor. The application of a Tier 2 method requires the use of a country specific emission factor based on representative measurements. The IPCC default emission factor for CH_4 emissions from composting is 10 g CH_4/kg waste treated on a dry weight basis and 4 g CH_4/kg based on a wet weight basis. The range of this emission factor varies between 0.8 and 11.4 g CH_4/kg waste treated. Most countries apply the default EF for CH_4 emissions (see

). Only Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Poland and Sweden present IEFs different from the default one and these EFs are much lower than the IPCC default EF but within the interval indicated in the 2006 IPCC guidelines.

Further methodological information for all countries is provided in the Annex of this submission

7.3.3 Incineration and open burning of waste (CRT Source Category 5.C)

This category includes incineration and open burning of waste. Emissions from waste incinerated for energy use are reported under 1A Fuel combustion activities. Emissions from field burning of agricultural wastes should be reported under 3 Agriculture.

Incineration and open burning of waste is not a key category for the European Union. Some additional information can be found in the chapter 3.6.8 dedicated to waste- non key categories.

7.3.4 Wastewater treatment and discharge (CRT Source Category 5D)

Source category 5D includes the CH_4 and N_2O emissions from domestic and industrial and other wastewater treatment and discharge. Methane and nitrous oxide are produced from microbial processes (anaerobic decomposition of organic matter, nitrification) in sewage systems and facilities. N_2O is also indirectly released from disposal of wastewater effluents into aquatic environments[45].

The subcategory 5D1 Domestic wastewater includes the handling of liquid wastes and sludges from housing and commercial sources through wastewater treatment, septic systems, latrines, lagoons, or discharge into surface waters. Industrial wastewater can also be released into domestic sewer systems and resulting emissions are in that case included under domestic wastewater. On the other hand, industrial wastewater can be treated on the industrial site and then the resulting emissions are be accounted under the separate category 5D2 industrial wastewater.

Total emissions from 5D wastewater handling, including N_2O and CH_4 emissions, account for 0.9 % of total EU GHG emissions including indirect CO_2, with LULUCF, in 2023.

[45] In most countries, indirect N_2O emissions from disposal of wastewater effluents are the major source of N_2O emissions from wastewater handling, whereas direct N_2O emissions from wastewater treatment plants are small or not relevant.

According to the key category analysis CH_4 and N_2O emissions from 5D1 Domestic wastewater and CH_4 emissions from 5D2 Industrial wastewater are an EU key source and analysed in more detail in this chapter. N_2O emissions from industrial wastewater are not a EU key source and are therefore not further analysed in this chapter.

Table 7.10 shows total GHG, CH_4 and N_2O emissions by Member State from 5D Wastewater Handling. Between 1990 and 2023, total emissions from wastewater handling decreased by 43 % in EU. All countries except for France and Ireland decreased their emissions from wastewater treatment and discharge between 1990 and 2023. Due to the increasing connexion rate of the population to wastewater treatment plant CH_4 emission decreased considerably by 56 % between 1990 and 2023, while N_2O emissions increased by 21 %.

Table 7.10 5D Wastewater handling: Countries' contributions to total GHG, CH_4 and N_2O emissions from 5D

Member State	GHG emissions in kt CO2 equivalents		N2O emissions in kt CO2 equivalents		CH4 emissions in kt CO2 equivalents	
	1990	2023	1990	2023	1990	2023
ustria	420	344	86	155	334	190
elgium	1 172	353	123	109	1 049	244
ulgaria	3 138	592	176	124	2 961	468
roatia	719	498	59	89	660	409
yprus	140	74	10	15	130	59
zechia	1 291	1 125	208	200	1 083	924
enmark	441	220	201	123	241	97
stonia	160	89	34	31	126	58
inland	315	233	68	63	247	170
rance	3 612	4 229	2 299	2 355	1 313	1 874
ermany	4 280	2 132	544	1 161	3 736	970
reece	2 871	1 602	249	256	2 622	1 347
ungary	995	575	140	309	855	266
eland	135	164	67	101	68	63
aly	4 703	3 864	1 120	1 231	3 584	2 633
atvia	429	122	47	32	382	90
ithuania	185	29	23	7	162	22
uxembourg	13	6	5	4	8	2
alta	28	17	9	7	19	10
etherlands	962	722	541	508	421	214
oland	5 926	2 854	660	934	5 266	1 920
ortugal	1 415	1 383	258	804	1 157	579
omania	4 098	1 830	383	376	3 715	1 454
lovakia	257	187	75	94	182	93
lovenia	350	170	35	33	315	137
pain	6 071	1 800	269	249	5 802	1 551
weden	371	376	201	184	170	192
U-27	**44 499**	**25 588**	**7 891**	**9 553**	**36 609**	**16 035**

Abbreviations explained in the Chapter 'Units and abbreviations'.

7.3.4.1 Domestic wastewater (CRT Source Category 5D1)

CH_4 emissions

CH_4 emissions from 5D1 Domestic Wastewater account for 0.4 % of total EU GHG emissions including indirect CO_2, with LULUCF in 2023.

Table 7.11 5D1 Domestic and commercial wastewater: Countries' contributions to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	333	184	187	1.8%	-146	-44%	3	1%	T2	CS,D
Belgium	1 049	246	244	2.3%	-805	-77%	-2	-1%	CR,T1	CR,D
Bulgaria	473	261	252	2.4%	-221	-47%	-9	-3%	T2	D
Croatia	551	318	310	2.9%	-242	-44%	-8	-3%	T1	D
Cyprus	103	24	24	0.2%	-79	-77%	0	1%	T1	D
Czechia	677	386	399	3.8%	-277	-41%	13	3%	T1	D
Denmark	122	94	93	0.9%	-29	-24%	-1	-1%	CS	CS
Estonia	126	57	56	0.5%	-70	-56%	-1	-2%	T1	D
Finland	218	152	152	1.4%	-66	-30%	-1	-1%	CS,T2	CS,D
France	1 245	1 790	1 796	17.1%	551	44%	6	0%	T2	CS,D
Germany	3 726	915	915	8.7%	-2 811	-75%	-1	0%	CS,D	CS,D
Greece	1 703	169	169	1.6%	-1 534	-90%	0	0%	D	D
Hungary	703	244	238	2.3%	-465	-66%	-6	-3%	T1,T2	D
Ireland	68	62	63	0.6%	-6	-8%	1	2%	T1,T2	CS,D
Italy	1 881	1 097	1 090	10.4%	-791	-42%	-7	-1%	T1	D
Latvia	229	88	87	0.8%	-141	-62%	0	0%	T2	CS
Lithuania	162	25	22	0.2%	-140	-86%	-2	-9%	T1,T2	D
Luxembourg	8	2	2	0.0%	-7	-80%	0	-11%	T1	CS
Malta	19	9	10	0.1%	-9	-47%	1	12%	D	CS
Netherlands	163	126	123	1.2%	-41	-25%	-3	-2%	T1,T2	D
Poland	4 551	1 671	1 662	15.8%	-2 889	-63%	-9	-1%	T1,T2	CS,D
Portugal	963	538	533	5.1%	-430	-45%	-5	-1%	T2	CS,D
Romania	3 292	1 359	1 332	12.7%	-1 960	-60%	-27	-2%	D	D
Slovakia	146	91	89	0.8%	-57	-39%	-2	-2%	T2	D
Slovenia	207	131	131	1.2%	-76	-37%	0	0%	T1	CS,D
Spain	3 876	361	360	3.4%	-3 516	-91%	-1	0%	T2	D
Sweden	164	186	186	1.8%	22	13%	0	0%	T2	CS
EU-27	**26 758**	**10 586**	**10 523**	**100%**	**-16 235**	**-61%**	**-62**	**-1%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

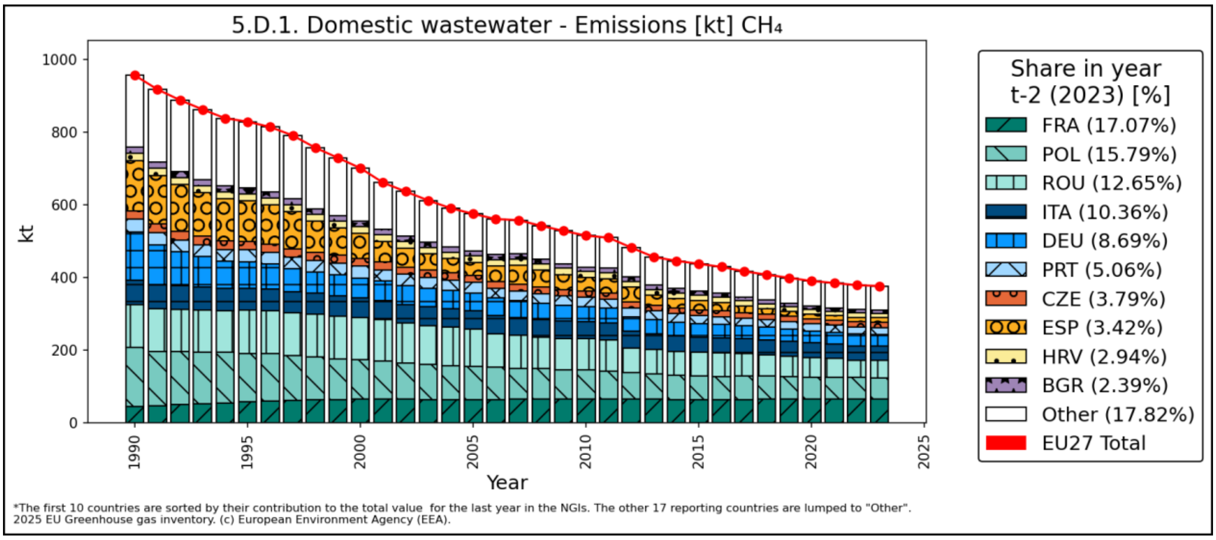
Trends in Emissions and Activity Data for CH_4 emissions from domestic wastewater

Figure 7.8 shows the trend of emissions indicating the countries contributing most to EU total.

CH_4 emissions from domestic wastewater treatment and discharge decreased considerably between 1990 and 2023 by 61 %. In 2023, CH_4 emissions decreased by 1 % in comparison to 2021.

Whereas France shows significant emission increases (+ 44 %) between 1990 and 2023, contributing to 17 % of EU emissions from source 5D1 in 2023. Although France increased its emissions, the trend of EU emissions is dominated by the large emission reductions in Spain, Poland and Germany which have large decreases in absolute terms between 1990 and 2023, contributing together to only 28% of EU emissions from source 5D1 in 2023.

Figure 7.8 5D1 Domestic wastewater: CH_4 emissions (Trend in relevant countries)



The decreasing trend of CH_4 emissions from wastewater is not related to a decreasing quantity of wastewater and the amount of the total organic product in the wastewater. Key drivers for the large emission reduction are the following:

- Improvements of wastewater disposal routes with the development of centralized wastewater treatment plants, especially applying aerobic processes
- Amount of sludge removed
- Increased share of CH_4 flared or recovered on anaerobic wastewater and sludge treatment systems

Methodological information for CH_4 emissions from domestic wastewater

All wastewater generated by households as well as any wastewater not disposed on-site in industrial installations is reported as domestic wastewater. CH_4 emissions from wastewater are formed by anaerobic conditions, these can originate during all stages: from wastewater generation to final disposal. CH_4 emissions from domestic wastewater handling (5D1) are a significant emission source in category 5D and key source in the EU.

An important remark in the interpretation of data on CH_4 recovery that are reported in the EU's CRT tables (and the countries CRT tables) for wastewater treatment (5D) is that, not all countries are reporting data related to CH_4 recovery, (for energy use of flaring) in CRT table 5D. The reported CH_4 recovery is generally recovered during sludge digestion for biogas production in a follow-up step of aerated wastewater treatment plants. On the opposite, CH_4 emissions relate mainly to anaerobic treatment systems (septic tanks and natural lagoons). Therefore, comparing CH_4 emissions to CH_4 recovery is meaningless.

Moreover, it must be highlight that some of the EU member states started to implement the 2019 refinement to the 2006 IPCC GB.

N_2O emissions

N_2O emissions from 5D1 Domestic Wastewater account for 0.3 % of total EU GHG emissions including indirect CO_2, with LULUCF, in 2023.

Table 7.12 5 D1 Domestic and commercial wastewater: Countries' contributions to N_2O emissions

Member State	N2O Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	85	151	153	1.7%	68	79%	2	1%	CS,D	CS,D
Belgium	123	106	109	1.2%	-14	-11%	3	3%	D	D
Bulgaria	176	124	124	1.4%	-52	-30%	0	0%	T1	D
Croatia	59	89	89	1.0%	30	50%	0	0%	T1	D
Cyprus	10	15	15	0.2%	5	57%	0	1%	T1	D
Czechia	208	198	200	2.3%	-8	-4%	2	1%	T1	CS,D
Denmark	154	112	114	1.3%	-40	-26%	2	2%	CS	CS
Estonia	34	31	31	0.4%	-3	-8%	1	3%	T1	D
Finland	49	53	54	0.6%	4	9%	1	2%	CS,T1	D
France	2 131	1 982	1 971	22.5%	-160	-7%	-11	-1%	T2	CS,D
Germany	516	1 136	1 137	13.0%	621	120%	2	0%	CS,D	CS,D
Greece	244	249	249	2.8%	5	2%	0	0%	D	CS
Hungary	140	307	309	3.5%	169	121%	2	1%	T1,T2	D
Ireland	67	99	101	1.2%	34	51%	2	2%	T1	D
Italy	1 059	1 168	1 189	13.5%	129	12%	21	2%	T1	D
Latvia	45	32	32	0.4%	-13	-29%	0	0%	D	D
Lithuania	23	8	7	0.1%	-16	-70%	-1	-10%	T1,T2	D
Luxembourg	5	4	4	0.0%	0	-7%	0	0%	T1	D
Malta	9	7	7	0.1%	-2	-21%	1	8%	D	D
Netherlands	374	423	426	4.9%	52	14%	3	1%	T2	D
Poland	52	731	736	8.4%	684	1308%	5	1%	T1	D
Portugal	240	780	795	9.1%	555	231%	15	2%	D	CS,D
Romania	383	373	376	4.3%	-7	-2%	3	1%	D	D
Slovakia	66	83	91	1.0%	25	38%	8	10%	T2	D
Slovenia	35	32	33	0.4%	-2	-7%	0	0%	T1	D
Spain	265	249	244	2.8%	-21	-8%	-5	-2%	D	D
Sweden	185	178	178	2.0%	-7	-4%	0	0%	T1	CS,D
EU-27	**6 739**	**8 718**	**8 774**	**100%**	**2 035**	**30%**	**56**	**1%**	**-**	**-**

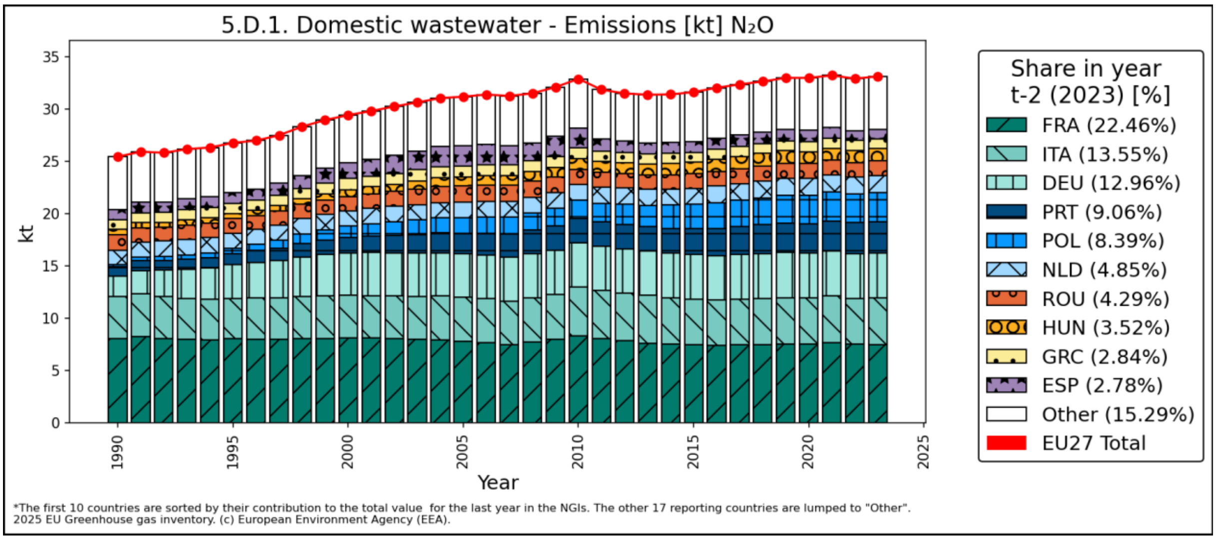
Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.

Trends in Emissions and Activity Data for N_2O emissions

N_2O emissions from domestic wastewater treatment and discharge increased between 1990 and 2023 by 30 % (Table 7.12). *Figure 7.9* shows the trend of emissions indicating the countries contributing most to EU total. The countries contributing most to the observed increase between 1990 and 2023 are Poland, Germany and Portugal and whereas France presents an important decrease in absolute value. In 2023, N_2O emissions decreased by 1 % in comparison to 2022 because of the important increase in absolute value observed for Portugal, Germany and Portugal.

Key drivers for the emission reduction are the development of centralized wastewater treatment plants with nitrogen abatement technologies.

Figure 7.9 5D1 Domestic wastewater: N_2O emissions (Trend in relevant countries)



Methodological information for N_2O emissions from domestic wastewater

Direct emissions of N_2O during processing only occur in countries with predominantly advanced centralized wastewater treatment plants with nitrification and denitrification steps. Indirect emissions come from wastewater treatment effluent discharged into environments.

For the calculation of N_2O emissions from domestic wastewater no different tier levels are provided in the IPCC 2006 Guidelines but the 2019 Refinement introduces a more complex methodology. Some countries apply the 2006 IPCC GB, some apply the 2019 refinement and, according to Table 7.12 some apply a country specific methodology and/or emission factors.

Further methodological information for all countries is provided in the Annex III of this submission.

7.3.4.2 Industrial wastewater (CRT Source Category 5D2)

CH_4 emissions from 5D2 Industrial Wastewater account for 0.2 % of total EU GHG emissions including indirect CO_2, with LULUCF in 2023.

Table 7.13 5D2 Industrial wastewater: Countries' contributions to CH_4 emissions

Member State	CH4 Emissions in kt CO2 equiv.			Share in EU-27 Emissions in 2023	Change 1990-2023		Change 2022-2023		Method	Emission factor Information
	1990	2022	2023		kt CO2 equiv.	%	kt CO2 equiv.	%		
Austria	1	4	3	0.1%	2	210%	-1	-17%	CS	CS,D
Belgium	IE	IE	IE	-	-	-	-	-	NA	NA
Bulgaria	2 488	231	216	4.0%	-2 272	-91%	-15	-6%	T2	D
Croatia	108	102	100	1.8%	-9	-8%	-2	-2%	T1	D
Cyprus	27	35	35	0.6%	8	29%	0	0%	T1	D
Czechia	406	529	525	9.7%	119	29%	-4	-1%	CS,T1	CS,D
Denmark	119	4	4	0.1%	-115	-97%	0	0%	CS	CS
Estonia	NO	4	2	0.0%	2	∞	-2	-53%	T1	D
Finland	30	20	18	0.3%	-12	-39%	-1	-7%	CS,T2	CS,D
France	68	84	78	1.4%	10	14%	-6	-7%	T2	CS,D
Germany	10	55	56	1.0%	45	437%	1	2%	CS,T2	CS
Greece	919	1 174	1 177	21.7%	258	28%	3	0%	CS,D	CS,D
Hungary	152	28	28	0.5%	-123	-81%	0	0%	T1	D
Ireland	IE	IE	IE	-	-	-	-	-	NA	NA
Italy	1 703	1 571	1 543	28.4%	-160	-9%	-28	-2%	T1	D
Latvia	154	3	3	0.0%	-151	-98%	-1	-23%	T1	PS
Lithuania	IE	IE	IE	-	-	-	-	-	NA	NA
Luxembourg	NO	NO	NO	-	-	-	-	-	NA	NA
Malta	IE	IE	IE	-	-	-	-	-	NA	NA
Netherlands	8	10	10	0.2%	2	25%	0	0%	T2	CS
Poland	715	256	258	4.8%	-457	-64%	2	1%	T1	CS,D
Portugal	194	55	46	0.9%	-147	-76%	-9	-16%	T2	CS,D
Romania	424	127	122	2.2%	-302	-71%	-5	-4%	D	D
Slovakia	36	4	4	0.1%	-32	-89%	-1	-12%	T1	D
Slovenia	108	7	6	0.1%	-101	-94%	0	-5%	T1	CS,D
Spain	1 925	1 324	1 191	21.9%	-735	-38%	-134	-10%	T1	CS,D
Sweden	7	8	6	0.1%	0	-6%	-2	-24%	T2	CS
EU-27	**9 601**	**5 635**	**5 431**	**100%**	**-4 170**	**-43%**	**-204**	**-4%**	**-**	**-**

Note: Presented methods and emission factor information refer to the last inventory year. Highlighted cells mark the three Member States with highest share in the EU sector total (yellow), highest decrease (green) and highest increase (red) in the respective period. Abbreviations are explained in the Chapter 'Units and abbreviations'.
Abbreviations explained in the Chapter 'Units and abbreviations'.

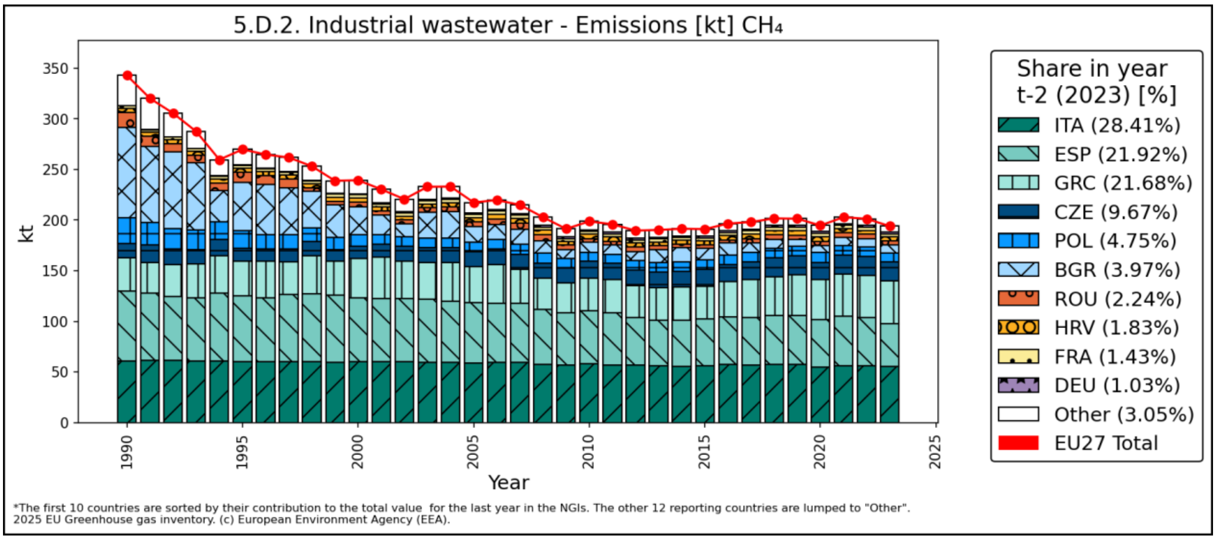
Trends in Emissions and Activity Data

CH_4 emissions from 5D2 industrial wastewater treatment and discharge decreased by 43 % between 1990 and 2023. In 2023, CH_4 emissions from this category decreased of 4 % in comparison to 2022 (see Table 7.13). *Figure 7.10* shows the trend of emissions indicating the countries contributing most to EU total.

The emission trends in this sector are mainly influenced by the strong decrease in Bulgaria.

Key drivers for the development of CH_4 emissions are primarily economic activities and the share of CH_4 flared or recovered. CH_4 emissions are related to production data in certain industries with high organic contents in the wastewater. Therefore, the trend in CH_4 emissions is fluctuating throughout the time series based on the economic situation in the countries.

Figure 7.10 5D2 Industrial wastewater: CH_4 emissions (Trend in relevant countries)



Methodological information

Emissions from industrial wastewater include all wastewater that is treated/disposed on-site and not sent to public sewers. The main sources for methane emissions from industrial wastewater are:

- pulp and paper manufacture;
- food and drink processing (e.g. meat and poultry processing, alcohol/starch production and dairy products); and
- Organic chemicals production.

Activity data is based on production output from the relevant industries and a Chemical Oxygen Demand per unit of output for each industry. Default IPCC values are provided and it is good practice to use them in the absence of national data.

There is an IPCC default value available for the maximum methane producing potential which is applied in most of the countries. In contrast, the MCF has to be determined country specifically and varies strongly among the countries depending on wastewater treatment systems used.

7.3.5 Waste – non-key categories

Table 7.14 Aggregated GHG emission from non-key categories in the waste sector

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 5. Waste in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
5.A.3. Uncategorized waste disposal sites: no classification (CH_4)	3 091.9	48.5	43.1	0.04%	-3 049	-99%	-5.5	-11%
5.B.1. Composting: no classification (N_2O)	306.1	1 746.8	1 733.6	1.59%	1 427	466%	-13.2	-1%
5.B.2. Anaerobic digestion at biogas facilities: no classification (CH_4)	8.2	1 895.6	1 973.1	1.81%	1 965	24057%	77.5	4%
5.B.2. Anaerobic digestion at biogas facilities: no classification (N_2O)	0.0	89.7	94.4	0.09%	94	100%	4.7	5%

EU-27	Aggregated GHG emissions in kt CO_2 equ.			Share in sector 5. Waste in 2023	Change 1990-2023		Change 2022-2023	
	1990	2022	2023		kt CO_2 equ.	%	kt CO_2 equ.	%
5.C.1. Waste incineration: no classification (CH_4)	27.5	13.9	8.7	0.01%	-19	-68%	-5.1	-37%
5.C.1. Waste incineration: no classification (CO_2)	3 290.3	2 234.8	1 967.9	1.80%	-1 322	-40%	-266.8	-12%
5.C.1. Waste incineration: no classification (N_2O)	188.0	101.0	99.2	0.09%	-89	-47%	-1.7	-2%
5.C.2. Open burning of waste: no classification (CH_4)	414.0	388.2	390.7	0.36%	-23	-6%	2.5	1%
5.C.2. Open burning of waste: no classification (CO_2)	83.4	30.1	29.7	0.03%	-54	-64%	-0.4	-1%
5.C.2. Open burning of waste: no classification (N_2O)	263.5	243.4	244.1	0.22%	-19	-7%	0.8	0%
5.D.2. Industrial wastewater: no classification (N_2O)	1 015.2	818.3	736.2	0.67%	-279	-27%	-82.1	-10%
5.D.3 Other: no classification (CH_4)	249.8	73.4	80.7	0.07%	-169	-68%	7.3	10%
5.D.3 Other: no classification (N_2O)	136.4	42.9	42.8	0.04%	-94	-69%	-0.1	0%
5.E Other: no classification (CH_4)	56.3	9.2	8.6	0.01%	-48	-85%	-0.6	-6%
5.E Other: no classification (CO_2)	16.5	14.9	12.0	0.01%	-4	-27%	-2.9	-19%
5.E Other: no classification (N_2O)	0.0	27.6	26.3	0.02%	26	100%	-1.2	-5%

7.4 EU uncertainty estimates

Table 7.15 shows the total EU uncertainty estimates for the sector Waste and the uncertainty estimates for the relevant gases of each source category. The highest level uncertainty was estimated for the category 5E (CO_2 and CH_4), followed by N_2O from 5D. Regarding the uncertainty on trend, N_2O and CH_4 from 5B show the highest uncertainty estimates. For a description of the Tier 1 uncertainty analysis carried out for the EU, see Chapter 1.6.

Table 7.15 Sector 5 -Waste: EU uncertainty estimates

Source category	Gas	Emissions Base Year	Emissions 2023	Emission trends Base Year-2023	Level uncertainty estimates based on MS uncertainty	Trend uncertainty estimates based on MS uncertainty
5.A Solid Waste Disposal	CO2	0	0	0,0%	0,0%	0,0%
5.A Solid Waste Disposal	CH4	135 338	73 924	-45,4%	43,6%	9,3%
5.A Solid Waste Disposal	N2O	0	0	0,0%	0,0%	0,0%
5.B Biological treatment of solid waste	CO2	0	0	0,0%	0,0%	0,0%
5.B Biological treatment of solid waste	CH4	521	4 758	813,3%	62,8%	303,9%
5.B Biological treatment of solid waste	N2O	230	1 543	570,1%	71,8%	220,3%
5.C Waste Incineration	CO2	3 249	1 998	-38,5%	21,7%	7,0%
5.C Waste Incineration	CH4	178	178	0,0%	35,6%	7,3%
5.C Waste Incineration	N2O	219	122	-44,5%	28,6%	12,6%
5.D Wastewater treatment and discharge	CO2	0	0	0,0%	0,0%	0,0%
5.D Wastewater treatment and discharge	CH4	36 609	16 035	-56,2%	68,3%	32,2%
5.D Wastewater treatment and discharge	N2O	7 621	9 304	22,1%	164,8%	69,3%
5.E Other	CO2	16	12	-27,1%	500,4%	135,6%
5.E Other	CH4	7	8	11,1%	350,4%	111,3%
5.E Other	N2O	0	26	Inf	20,1%	Inf
5 (where no subsector data were submitted)	all	1 015	978	-3,6%	39,7%	34,7%
Total - 5	**all**	**185 004**	**108 885**	**-41,1%**	**34,8%**	**9,8%**

***Note**: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points; the sum of the source category emissions may not be the total sector emissions of the EU-NID because uncertainty estimates are not available for all source categories in all countries;*

7.5 Sector-specific quality assurance and quality control

There are several activities for improving the quality of estimating and reporting GHG emissions from waste: Before and during the compilation of the EU GHG inventory, several checks are made of the countries data in particular for completeness, time series consistency of emissions and implied emission factors, comparisons of implied emission factors across countries and checks of internal consistency.

In the second half of the year, the EU internal review is carried out for selected source categories. In 2005, the EU internal review was carried out for the first time. In 2012 a comprehensive review was carried out for all sectors and all EU countries in order to Source category Gas Emissions fix the base year 2020 under the EU Effort Sharing Decision. (ESD review 2012). This review also covered the waste sector of the MS GHG inventories (peer review). In 2015, a few countries volunteered to be reviewed under step 2 of the ESD trial review for the sector waste. In 2016, again a comprehensive review was carried out for all sectors and all EU countries with a focus on the years 2005, 2008-2010, 2013 and 2014 in order to track progress of the EU countries under the EU Effort Sharing Decision. (ESD review 2016).

In March 2016, during the WG1-meeting, a note/paper on wastewater treatment and discharge was discussed with the countries. This note/paper reflects a number of concerns raised during the ESD 2015 trial review. In connection to the ESD review further capacity building activities between the ESD review team and EU sectoral experts have taken place via webinars and distribution of working papers on the main conclusions from the ESD reviews.

In September 2017 a capacity building webinar related to the waste sector was organized between the ESD review team and the countries. Several aspects on solid waste disposal, biological treatment and wastewater treatment were discussed. A second webinar took place in November 2017 in order to discuss in more detail the different interpretations when using equations 6.1-6.3 of the IPCC 2006 guidelines (Volume 5, chapter 6) for calculating emissions from wastewater treatment. An elaborated spreadsheet, along with a brief explanation of the spreadsheet was presented and explained during the webinar.

In the autumn of 2018 a capacity building webinar related to the waste sector was organized where the ESD review team informed the Countries on specific aspects that were handled and discussed during the ESD review round in 2018.

In the autumn of 2019 a capacity building webinar related to the waste sector was organized where the ESD review team informed the Countries on specific aspects that were handled and discussed during the ESD review round in 2019.

In the autumn of 2020 a capacity building webinar related to the waste sector was organized where the ESD review team informed the Countries on specific aspects that were handled and discussed during the ESD review round in 2020.

In the autumn of 2021 a capacity building webinar related to the waste sector was organized where the ESD review team informed the Countries on specific aspects that were handled and discussed during the ESD review round in 2021.

In 2024, the EU provided bilateral capacity building for the MSs to improve inventory.

In 2024, the transfer from the CRF reporting to ETF reporting tool was quality checked by comparing MSs’s estimates of the two reporting tools.

7.6 Sector-specific improvements

In 2024, the reporting has been amended to be in line with the new CRT reporting tables, as well as the NID outline. Descriptions of categories have been aligned accordingly. Information across sectors has been streamlined to provide a harmonised approach across the whole NID. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

Improvements planned for the next reporting are continuing the efforts to ensure consistency between CRT/JSON files and NID, and the provision of sufficient information to meet transparency requirements.

8 OTHER

Sector Other is not an EU key category (see Annex 1.1) and does not include any emissions in 2025

9 INDIRECT CO_2 AND N_2O EMISSIONS

9.1 Description of sources of indirect emissions in the GHG inventory

The CO_2 resulting from the atmospheric oxidation of CH_4, CO and NMVOC is referred to as indirect CO_2. Indirect CO_2 resulting from the oxidation of CH_4, CO and NMVOCs produced by fossil fuel combustion are included in the general methodological approach which assumes that all the carbon in the fuel (minus the portion that remains as soot or ash) is oxidized to CO_2 whereas a fraction of this carbon is initially emitted as CH_4, CO or NMVOC.

Total indirect CO_2 emissions at EU level are based on emission sources reported by those Member States estimating and reporting indirect CO_2, and consistent with the methodological guidance provided in the 2006 IPCC Guidelines.

Indirect CO_2 emissions from solvent use, road paving with asphalt and asphalt roofing are generally reported under CRT category 2D3 ,'non-energy products from fuels and solvent use according to UNFCCC Reporting Guidelines. For other sources of indirect CO_2, emissions are reported in CRT Table 6.

Indirect CO_2 only includes fossil carbon and excludes biogenic sources and combustion-fuels where IPCC default CO_2 emission factors (i.e. full oxidation with factor equal to 1) are assumed.

Indirect N_2O emissions in the agriculture sector address nitrous oxide (N_2O) emissions that result from the deposition of the nitrogen emitted as nitrogen oxides (NO_X) and ammonia (NH_3). N_2O is produced in soils through the biological processes of nitrification and denitrification. One of the main controlling factors in this reaction is the availability of inorganic nitrogen in the soil and therefore deposition of nitrogen resulting from NO_X and NH_3 will enhance emissions.

In addition to agriculture, the 2006 IPCC Guidelines include guidance for estimating N_2O emissions resulting from nitrogen deposition of all anthropogenic sources of NO_X and NH_3 (in particular from sources in the energy and IPPU sectors). The 2006 IPCC Guidelines, Volume 5, also address indirect N_2O emissions which occur from the release of wastewater effluents into waterways, lakes or the sea.

As with indirect $CO_{2,}$ indirect N_2O emissions at EU level are fully consistent with estimation methods used by Member States.

The EU GHG national total includes indirect CO_2 if these emissions have been reported by Member States. Both national totals, including and excluding indirect CO_2, are reported in the CRT tables. Indirect N_2O emissions reported in Summary 1 are not included in national GHG totals.

This chapter refers to the indirect emissions that are reported in Table 6 of the EU CRT tables. As mentioned above, indirect emissions are also included in other sectors, such as indirect CO_2 in IPPU (i.e. under ‘2D Non-energy products from fuels and solvents’) and indirect N_2O in the agriculture and LULUCF sectors (i.e. in CRT tables 3.D and 3.B.b or table 4(IV)). These emissions are dealt with in the corresponding sectoral chapters.

9.2 Methodological issues

Table 9.1 summarizes indirect CO_2 and nitrous oxide emissions reported by EU Member States. Twelve countries provided values for indirect CO_2 emissions. The highest shares of the EU total of indirect CO_2 emissions are reported by France (23.2 %) and Italy (24.8 %). Seven countries reported indirect N_2O emissions for the year 2023, with Bulgaria, Romania and Italy accounting together for 86 % of the total EU indirect N_2O emissions.

Indirect CO_2 is not an EU key category.

Table 9.1 Indirect CO_2 and N_2O emission for the EU in 2023

Countries	indirect CO_2 [kt CO_2 equ.]	Share in EU [%]	indirect N_2O [kt CO_2 equ.]	Share in EU [%]
Austria	IE,NA,NE,NO	-	NA,NE,NO	-
Belgium	IE,NE,NO	-	NE,NO	-
Bulgaria	NE,NO	-	3.25	20.1%
Croatia	NA,NO	-	NA,NO	-
Cyprus	7	0.2%	NE,NO	-
Czechia	431	12.5%	0.60	3.7%
Denmark	276	8.0%	0.65	4.0%
Estonia	IE,NE,NO	-	IE,NE,NO	-
Finland	48	1.4%	0.39	2.4%
France	800	23.2%	-	-
Germany	NE,NO	-	IE,NE,NO	-
Greece	NE	-	NE	-
Hungary	NE	-	NE	-
Ireland	IE,NA,NE	-	NA,NE,NO	-
Italy	855	24.8%	2.75	17.0%
Latvia	12	0.3%	IE,NA,NO	-
Lithuania	39	1.1%	NO	-
Luxembourg	NA,NO	-	NA,NO	-
Malta	NA,NE,NO	-	0.01	0.0%
Netherlands	433	12.6%	NE,NO	-
Poland	376	10.9%	NA,NO	-
Portugal	126	3.6%	NA,NE,NO	-
Romania	NE,NO	-	7.96	49.2%
Slovakia	41	1.2%	NE,NO	-
Slovenia	NA,NE	-	NA,NE	-
Spain	NE,NO	-	NE,NO	-
Sweden	NE,NO	-	0.57	3.5%
EU	**3 442**	**100%**	**16**	**100%**

The methodologies for the estimation of indirect emissions in EU countries are consistent with the 2006 IPCC Guidelines.

For the estimation of indirect CO_2 emissions EU countries follow the basic principle proposed by the IPCC for calculating the CO_2 inputs from the atmospheric oxidation of CH_4, CO or NMVOC (2006 IPCC Guidelines, Volume 1, Chapter 7, p. 7.6):

From CH_4: $\text{Inputs}_{CO2} = \text{Emissions}_{CH4} \bullet 44/16$

From CO: $\text{Inputs}_{CO2} = \text{Emissions}_{CO} \bullet 44/28$

From NMVOC: $\text{Inputs}_{CO2} = \text{Emissions}_{NMVOC} \bullet C \bullet 44/12$

Where C is the fraction carbon in NMVOC by mass (default = 0.6)

Some countries (i.e. CZE, DNM) explicitly mention that the precursor gases emissions (CO, NO_X and NMVOC) used in the above equations are consistent with the precursor gases emissions reported under the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) and the CH_4 emissions reported to the UNFCCC.

In general, emissions reported in Table 6 refer to indirect emissions from energy, IPPU and waste, while some countries report the indirect CO_2 emissions in other categories too (e.g. in the IPPU category 2.D.3).

9.3 Uncertainties and time-series consistency

Indirect CO_2 emissions have decreased since 1990 in all countries but Poland (+46%), Lithuania (+12%) and Portugal (+35%). The highest percentage decrease has been reported by Denmark (-78 %), while in absolute terms Czechia had the biggest share in the EU reduction, decreasing its indirect CO_2 emissions by 1.2 Mt. The main reason for the decrease in indirect CO_2 emissions is the decrease of the precursor gases emissions. Since 1990, indirect N_2O emissions decreased in all seven reporting countries.

The uncertainty of the indirect emission estimates is also based on the calculation of emissions from these gases.

9.4 Category specific planned improvements

The separate reporting of indirect CO_2 and nitrous oxide emissions (from sources other than agriculture and LULUCF) to the UNFCCC under CRT Table 6 has been performed for the first time in 2015 and is in line with paragraph 29 of the UNFCCC reporting guidelines (Decision 24/CP.19). Following this reporting the EU team analysed the ways that countries reported these emissions and presented the results in Working Group 1 of the Climate Change Committee of the European Commission. The different approaches have been discussed and guidance was provided to Member States in order to improve the consistency in the reporting of these emissions.

10 RECALCULATIONS AND IMPROVEMENTS

10.1 Main recalculations

Recalculations presented are calculated from countries submissions (CRT tables) used for the EU submission in December 2024 and MS submissions received in March 2025.

Table 10.1 provides an overview of recalculations within the EU GHG inventory for all years by source category (>+/- 1000 kt CO_2 equiv.) in the year 1990 and 2022 for the EU-27, together with explanations for these as provided in the NIRs of Member States. It can be seen that the largest recalculation in 1990 and 2022 occurred in the categories, 4A Forest Land, 1A3 Transport and 1A4 Other Sectors, and 2022 also within the category 4B Cropland.

Table 10.1 Recalculations by source category for 1990-2022 in kt CO_2 eq.)

	1990	1995	2000	2005	2010	2015	2020	2021	2022	Main Explanations
Total (net emissions)	**- 1 002**	**- 1 167**	**- 1 572**	**- 1 217**	**-239**	**1 561**	**4 391**	**1 635**	**1 663**	
1. Energy	**- 1 279**	**- 1 369**	**- 1 752**	**- 1 392**	**-398**	**1 422**	**4 279**	**1 523**	**1 544**	
1.A. Fuel combustion	**1 107**	**748**	**102**	**304**	**1 225**	**1 975**	**4 772**	**2 396**	**2 602**	
1.A.1.Energy industries	-781	-833	- 1 000	964	1 136	1 394	2 033	602	3 347	The main resons for the recalculation are due to the recaulcation of the CO_2 EF in the case of caols burned in Spanush thermal power plants, using plant specific oxidation factors. Also, the revision of the energy balance for the latest years leads to annual recalculations. The global impact on the category is very low.
1.A.2.Manufacturing industries and construction	-314	-221	-396	- 1 652	- 1 431	- 1 168	612	- 1 214	- 3 079	Update in energy balance most of the EU MS, change in emission for category 1.A.2.a (2021) and activity data in 1.A.2.g vii by Germany, 1.A.2.g mobile combustion activity data by Sweden (annual machine operating hours, emission from diesel and gasoline vehicles - allocation of fossil and biogenic component of the fuel mix), change in energy balance for the industry sector (2011-2022) by France
1.A.3.Transport	2 012	1 529	1 231	924	1 156	1 141	988	1 117	632	The main reason for reason for recalculations is the update on the activity data calculation methodology, for the 1.A.3.b Road Transportation in CZE
1.A.4.Other sectors	26 610	30 035	35 632	42 236	46 145	38 886	38 682	40 211	37 964	This recalculation is almost entirely due to an error in the ETF tool (version 2024) that inadvertently inserted the key 'NO' instead of the aggregated values of the individual fuels in the Spanish inventory when automatically generating totals and subtotals for sector 1.A.4. This error resulted in some subcategories having the value 'NO' in this submission when in fact the correct emission values should have been used. The situation has been corrected in the 2025 edition, which includes updated calculations and corrected emissions data. The Spain's total was correct and that is the reason why we didn't notice this last year when we checked just the summary tables in the autumn.
1.A.5.Other	0	-0	-1	-2	-15	9	9	8	-13	

	1990	1995	2000	2005	2010	2015	2020	2021	2022	Main Explanations
1.B. Fugitive emissions from fuels	**- 2 109**	**- 1 915**	**- 1 674**	**- 1 520**	**- 1 464**	**-414**	**-381**	**-761**	**-939**	
1.B.1.Solid fuels	- 2 770	- 2 532	- 2 308	- 2 089	- 1 845	- 1 591	- 1 150	- 1 136	- 1 191	The main reason for recalculations is the update of Emission factor for category 1.B.1.a.ii.1 (surface mining) in CZE
1.B.2.Oil and natural gas and other emissions from energy production	661	617	634	569	381	1 177	769	375	252	Recalculations in this category are caused by SWE, who reported emissions from this source in previous submissions as confidential (Notation key 'C')
1.C. CO_2 transport and storage	-	-	-	-	-	-	-	-	-	
2.Industrial processes and product use	**5**	**-172**	**-164**	**-413**	**-636**	**536**	**1 327**	**-84**	**1 190**	
2.A.Mineral industry	-4	0	9	2	27	-24	97	103	1 655	Correction of a reporting error, which occurred in last year's submission by Sweden.
2.B.Chemical industry	216	-2	68	225	84	12	399	26	-360	
2.C.Metal industry	-1	0	-0	0	0	732	704	2	-82	Significant recalculations (about 700 kt) between 2015 and 2020 are due to problems of confidential data reporting for Sweden in the November 2024 submission. Compared to last March 2024 submission, no significant change is to be noticed.
2.D.Non-energy products from fuels and solvent use	-199	-134	-102	-141	-134	-138	94	192	26	
2.E.Electronic Industry	0	-	-	-0	-	-0	3	10	30	
2.F.Product uses as ODS substitutes	0	-34	-133	-608	-678	-152	-76	-353	-115	
2.G.Other product manufacture and use	-8	-8	-13	103	97	118	117	-53	31	
2.H.Other	0	5	7	5	-31	-12	-11	-12	5	
3.Agriculture	**6 292**	**6 882**	**5 236**	**4 895**	**5 841**	**3 197**	**4 031**	**4 415**	**1 955**	
3.A.Enteric fermentation	3 399	2 507	1 853	1 286	1 143	908	702	457	682	Updated method in France (upward revision), partly compensated through time by an updated Tier 2 method in Ireland (downward revision) and the implementation of the 2019 IPCC guidelines values for the parameter Ym in Spain (downward revision)
3.B.Manure management	2 959	2 762	2 472	2 527	2 583	2 333	2 018	1 993	1 938	Updated method in France (upward revision for CH_4), new Tier 3 method in Denmark for liquid manure from cattle and swine (upward revision for CH_4), implementation of the 2019 IPCC

	1990	1995	2000	2005	2010	2015	2020	2021	2022	Main Explanations
										guidelines values for solid storage in Germany (upward revision for N_2O)
3.C.Rice cultivation	3 095	2 896	2 834	3 132	3 506	3 114	2 753	2 671	2 495	
3.D.Agricultural soils	-261	1 477	868	1 100	2 100	-18	1 499	2 166	-282	Implementation of the 2019 IPCC guidelines value for wet climate for the emission factor for indirect N_2O from volatilisation in Germany (upward revision), updated method in Spain for N_2O emissions from animal manure applied to soils using the N spread without deducting losses (upward revision), implementation of the 2023 Emep guidebook in France (upward revision for indirect emissions), updated method for crop residues in Italy (upward revision).
3.E.Prescribed burning of savannahs	-	-	-	-	-	-	-	-	-	
3.F.Field burning of agricultural residues	191	133	29	-34	-6	-27	-33	-31	-31	
3.G. Liming	1	1	1	1	1	-0	-2	-77	-156	
3.H. Urea application	-0	-0	-0	0	-0	-5	-39	-0	-6	
3.I. Other carbon-containing fertilizers	-0	-0	-0	0	-0	0	-50	-0	-28	
3.J.Other	0	0	0	2	4	-10	-80	-105	14	
4. Land use, land-use change and forestry	**- 19 869**	**1 730**	**- 7 065**	**1 153**	**5 531**	**5 939**	**47 011**	**44 962**	**53 168**	
4.A. Forest land	- 23 444	- 3 255	- 15 087	- 11 281	2 229	-168	38 219	41 401	39 975	New NFI data for forest land has led to significant recalculation of 2022. This mainly reflects the large loss due to natural disturbances and impacts of climate change that became visible with the more recent inventory data.
4.B. Cropland	7 543	9 452	9 902	10 175	10 835	12 291	13 699	13 212	14 116	New as well as adjusted models for soil carbon together with more sample plots in both organic and mineral soils has led to recalculation with more emissions.
4.C. Grassland	- 1 411	- 1 994	72	3 983	- 3 038	- 2 379	-573	- 4 630	553	Recalculations reflect both improved soil maps and the allocation of organic and mineral soils which has reduced emissions reported under grassland as well as better land use change data which means in some instances that MS have corrected earlier estimates of land use conversions from forest land to grassland leading to less emissions.
4.D. Wetlands	557	794	718	280	229	-253	201	-802	453	

	1990	1995	2000	2005	2010	2015	2020	2021	2022	Main Explanations
4.E. Settlements	- 2 336	- 2 564	- 1 836	- 1 167	- 3 751	- 2 523	- 3 116	- 3 680	- 2 693	Improved monitoring that have allowed an improved estimation of biomass loss for land converted to settlements leading to reporting of less loss of biomass.
4.F. Other land	-60	-43	-19	-9	-43	-40	-20	-24	-15	
4.G. Harvested wood products	-366	-824	-570	-386	-251	-258	- 1 486	-257	1 036	Recalculations due to correction of error in activity data in the 2024 submission.
4.H. Other	-	-	-	-	-	-	-	-	-	
5.Waste	**912**	**382**	**-136**	**318**	**1 356**	**1 287**	**1 051**	**1 617**	**1 561**	
5.A.Solid waste disposal	131	98	97	81	104	-298	-90	185	771	
5.B.Biological treatment of solid waste	4	10	0	-1	-48	-300	-3	-93	-262	
5.C.Incineration and open burning of waste	-394	-310	-316	-169	-193	-225	-259	-256	-572	
5.D.Waste water treatment and discharge	1 170	585	84	408	1 492	2 110	1 835	2 193	2 017	The main reason for recalculations is that some MS implemented the 2019 Refinement regarding Wastewater treatment and Discharge, resulting in higher emissions as expected.
5.E.Other	0	0	0	0	0	0	0	0	-1	
6.Other *(as specified in summary 1)*	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

Note: The green color code marks recalculations <-1000 kt CO_2 eq and the red colour code markes recalculations >1000 kt CO_2eq

Recalculations in the Energy sector are mainly due to improvements in the UNFCCC ETF reporting tool affecting emissions in the residential sector (1.A.4).

10.2 Implications for emission levels

Table 10.2 provides the differences in total GHG emissions (with LULUCF) between the latest submission and the previous submission in absolute and relative terms for the EU. The table shows that due to recalculations, total 1990 net GHG emissions have decreased in the latest submission compared to the previous submission by 13 767 kt (0.3 %), while total 2022 net EU GHG emissions increased by 59 532 kt CO_2 eq.

Table 10.2 Overview of recalculations of EU total GHG emissions (difference between latest submission and previous submission in kt CO_2 equivalents)

		1990	1995	2000	2005	2010	2015	2020	2021	2022
Total CO_2 equivalent emissions including LULUCF	kt	- 13 767	7 599	- 3 696	4 760	11 898	12 585	57 942	52 579	59 532
	%	-0.30%	0.18%	-0.09%	0.11%	0.31%	0.36%	1.90%	1.63%	1.90%
Total CO_2 equivalent emissions excluding LULUCF	kt	6 101	5 868	3 369	3 606	6 367	6 647	10 931	7 617	6 364
	%	0.13%	0.13%	0.08%	0.08%	0.15%	0.17%	0.33%	0.22%	0.19%

Table 10.3 provides an overview of recalculations for the key categories for 1990 and 2022 (see chapter 1 for information on identification of key categories). The table shows that the largest recalculations in absolute terms were made in sector energy (1A2, 1A4 for CO_2 and 1B1 for CH_4) and the sector LULUCF (4A, 4B and 4E for CO_2).

Table 10.3 Recalculations for EU key source categories 1990 and 2022 (difference between latest submission and previous submission in kt of CO_2 equivalents and in percentage)

Greenhouse Gas Source Categories	Gas	Recalculations 1990		Recalculations 2022	
		(kt CO_2 eq)	(%)	(kt CO_2 eq)	(%)
1.A.1. Energy Industries	CO_2	-828	-0.1%	3 311	0.4%
1.A.2. Manufacturing Industries	CO_2	-311	0.0%	-3 042	-0.8%
1.A.3. Transport	CO_2	1 965	0.3%	716	0.1%
1.A.3. Transport	CH_4	22	0.3%	- 68	-5.4%
1.A.3. Transport	N_2O	26	0.5%	- 16	-0.2%
1.A.4. Other Sectors	CO_2	25 497	3.9%	36 411	8.8%
1.A.4. Other Sectors	CH_4	926	4.1%	1 355	8.4%
1.A.5. Other	CO_2	-0	0.0%	- 15	-0.2%
1.B.1. Solid Fuels	CH_4	- 2 770	-3.2%	-1 220	-4.9%
1.B.2. Oil and Natural Gas	CH_4	669	1.1%	194	1.2%
1.B.2. Oil and Natural Gas	CO_2	-8	0.0%	58	0.4%
2.A. Mineral Industry	CO_2	-4	0.0%	1 655	1.7%
2.B. Chemical Industry	CO_2	-1	0.0%	- 412	-0.9%
2.B. Chemical Industry	Unspecified mix of HFCs and PFCs	117	2.5%	15	63.4%
2.B. Chemical Industry	N_2O	100	0.1%	37	1.2%
2.C. Metal Industry	CO_2	-1	0.0%	- 82	-0.1%
2.F. Product uses as substitute for ODS	HFC	-	0.0%	- 138	-0.2%
3.A. Enteric Fermentation	CH_4	3 399	1.4%	682	0.4%
3.B. Manure Management	CH_4	1 362	2.5%	1 429	3.2%
3.B. Manure Management	N_2O	1 596	6.2%	509	2.9%
3.D. Agricultural Soils	N_2O	-261	-0.2%	- 282	-0.3%

Greenhouse Gas Source Categories	Gas	Recalculations 1990		Recalculations 2022	
		(kt CO_2 eq)	(%)	(kt CO_2 eq)	(%)
3.G. Liming	CO_2	1	0.0%	- 156	-2.7%
4.A. Forest Land	CO_2	- 23 512	6.6%	39 570	-13.2%
4.A. Forest Land	N_2O	251	5.4%	458	9.6%
4.B. Cropland	CO_2	6 785	10.5%	13 791	69.5%
4.C. Grassland	CO_2	- 2 108	-5.5%	609	3.9%
4.D. Wetlands	CO_2	113	1.1%	459	3.2%
4.D. Wetlands	CH_4	439	5.5%	- 31	-0.4%
4.E. Settlements	CO_2	- 2 336	-9.7%	-2 650	-10.3%
4.E. Settlements	N_2O	-10	-0.4%	- 40	-1.3%
4.G. Harvested wood products	CO_2	25	-0.1%	1 434	-3.6%
5.A. Solid Waste Disposal	CH_4	131	0.1%	771	1.0%
5.D. Waste Water treatment and discharge	CH_4	389	1.1%	121	0.8%
5.D. Waste Water treatment and discharge	N_2O	782	11.0%	1 896	24.7%

Note: *The source categories are presented in a more aggregated than the EU key source categories identified in Section 1.5. Highlighted are the top 6 highest recalculations for each year.*

Table 10.4 and Table 10.5 give an overview of absolute and relative changes of Member States' emissions due to recalculations for 1990 and 2022. Recalculations of more than 1000 kt of CO_2 equivalents were made by 9 countries in 1990, and 12 countries in 2022. For the EU this resulted in a relative change of -0.3 % in 1990 emissions and +1.9 % in 2022. In 1990, the highest recalculations was made by Sweden, and in 2022 by France influencing significantly the total EU recalculations. On country level, the highest recalculations in relative terms were made by Sweden, followed by Slovenia and Germany.

Table 10.4 Contribution of countries to EU recalculations of total GHG emissions (with LULUCF) for 1990–2022 (absolute difference between latest submission and previous submission kt of CO_2 equivalents)

	1990	1995	2000	2005	2010	2015	2020	2021	2022
Austria	-1 533	1 524	-3 351	3 609	8 357	2 577	5 546	8 431	4 942
Belgium	-107	-145	-476	-506	-354	-536	-454	-468	-684
Bulgaria	743	609	648	758	496	420	371	461	438
Croatia	5	-4	-5	-8	-13	-13	-15	-8	-28
Cyprus	3	-5	-13	-11	-35	-24	-454	-541	-436
Czechia	-5 770	-2 959	-3 302	-3 237	-2 454	-4 307	-4 247	-4 183	-4 612
Denmark	839	745	777	875	875	972	836	766	689
Estonia	269	412	510	489	-112	-190	-107	28	58
Finland	1 222	917	728	787	1 579	1 926	7 284	8 085	7 622
France	3 004	2 701	3 276	2 682	3 450	3 183	-9 799	-7 783	-7 700
Germany	5 004	14 564	10 883	15 121	9 071	16 242	72 098	62 301	70 056
Greece	-12	-20	-14	-2	-9	801	74	-24	-334
Hungary	-139	-122	-65	156	456	352	272	283	206
Ireland	592	46	-474	-1 038	-1 087	-1 152	-1 573	-1 852	-1 973
Italy	418	458	472	458	517	950	-11 380	-12 400	-18 147
Latvia	-125	-116	-170	-696	-178	-95	-226	-245	744
Lithuania	483	-146	-793	-1 120	-677	109	481	-343	40
Luxembourg	39	42	49	26	36	-61	-68	-75	-74
Malta	0	0	0	0	0	-2	0	2	-3
Netherlands	-592	-566	-544	-522	-427	-458	-485	-873	-1 421
Poland	-4 521	-4 459	-4 504	-3 805	-2 984	-1 243	-907	-1 065	-470

	1990	1995	2000	2005	2010	2015	2020	2021	2022
Portugal	-2 760	5 442	3 502	912	3 384	1 098	1 043	3 259	5 521
Romania	-23	-131	-244	246	-1	-118	-87	223	474
Slovakia	58	-559	-542	-346	-412	-387	-220	-287	-173
Slovenia	50	37	32	19	0	4	-3 963	-4 019	-4 103
Spain	-2 903	-3 236	-2 432	-2 481	-2 558	-6 566	-5 472	-5 198	-5 104
Sweden	-8 010	-7 429	-7 644	-7 608	-5 021	-897	9 393	8 103	14 002
EU27	**-13 767**	**7 599**	**-3 696**	**4 760**	**11 898**	**12 585**	**57 942**	**52 579**	**59 532**

Note: Red marked are all Member State recalculations > +/- 1000 kt CO_2 equivalents

Table 10.5 Contribution of Member States to EU recalculations of total GHG,(with LULUCF) for 1990–2022 (relative difference between latest submission and previous submission in %)

	1990	1995	2000	2005	2010	2015	2020	2021	2022
Austria	-2.3%	2.5%	-5.0%	4.8%	12.8%	3.5%	8.1%	12.7%	7.2%
Belgium	-0.1%	-0.1%	-0.3%	-0.4%	-0.3%	-0.5%	-0.4%	-0.4%	-0.7%
Bulgaria	0.9%	1.1%	1.6%	1.6%	1.0%	0.8%	1.0%	1.0%	0.9%
Croatia	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	0.0%	-0.1%
Cyprus	0.1%	-0.1%	-0.2%	-0.1%	-0.4%	-0.3%	-5.5%	-6.4%	-5.1%
Czechia	-3.0%	-2.0%	-2.3%	-2.3%	-1.8%	-3.5%	-3.4%	-3.3%	-3.8%
Denmark	1.1%	0.9%	1.0%	1.2%	1.3%	2.0%	1.9%	1.8%	1.7%
Estonia	0.8%	2.7%	3.7%	3.0%	-0.7%	-1.0%	-0.8%	0.2%	0.4%
Finland	2.5%	1.8%	1.5%	1.8%	3.0%	4.6%	17.2%	15.8%	15.2%
France	0.6%	0.5%	0.6%	0.5%	0.7%	0.8%	-2.7%	-2.0%	-2.0%
Germany	0.4%	1.3%	1.1%	1.5%	1.0%	1.8%	9.8%	8.2%	9.3%
Greece	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.1%	0.0%	-0.5%
Hungary	-0.2%	-0.2%	-0.1%	0.2%	0.7%	0.6%	0.5%	0.5%	0.4%
Ireland	1.0%	0.1%	-0.6%	-1.3%	-1.6%	-1.8%	-2.5%	-2.8%	-3.1%
Italy	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	-3.2%	-3.2%	-4.6%
Latvia	-0.9%	-5.2%	-10.2%	-13.5%	-1.8%	-0.9%	-2.0%	-1.9%	4.9%
Lithuania	1.1%	-0.8%	-8.0%	-6.2%	-6.6%	0.9%	3.4%	-2.3%	0.3%
Luxembourg	0.3%	0.4%	0.5%	0.2%	0.3%	-0.6%	-0.8%	-0.9%	-1.0%
Malta	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	-0.1%
Netherlands	-0.3%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.3%	-0.5%	-0.9%
Poland	-1.0%	-1.0%	-1.3%	-1.1%	-0.8%	-0.4%	-0.3%	-0.3%	-0.1%
Portugal	-4.2%	9.3%	4.4%	1.0%	5.4%	1.7%	2.0%	6.5%	10.9%
Romania	0.0%	-0.1%	-0.2%	0.2%	0.0%	-0.2%	-0.1%	0.3%	0.7%
Slovakia	0.1%	-1.3%	-1.4%	-0.7%	-1.0%	-1.1%	-0.7%	-0.8%	-0.6%
Slovenia	0.3%	0.3%	0.3%	0.1%	0.0%	0.0%	-25.5%	-25.5%	-26.6%
Spain	-1.1%	-1.1%	-0.7%	-0.6%	-0.8%	-2.3%	-2.4%	-2.2%	-2.1%
Sweden	-40.3%	-29.4%	-51.7%	-48.7%	-68.4%	-78.9%	340.1%	274.5%	410.1%
EU27	**-0.3%**	**0.2%**	**-0.1%**	**0.1%**	**0.3%**	**0.4%**	**1.9%**	**1.6%**	**1.9%**

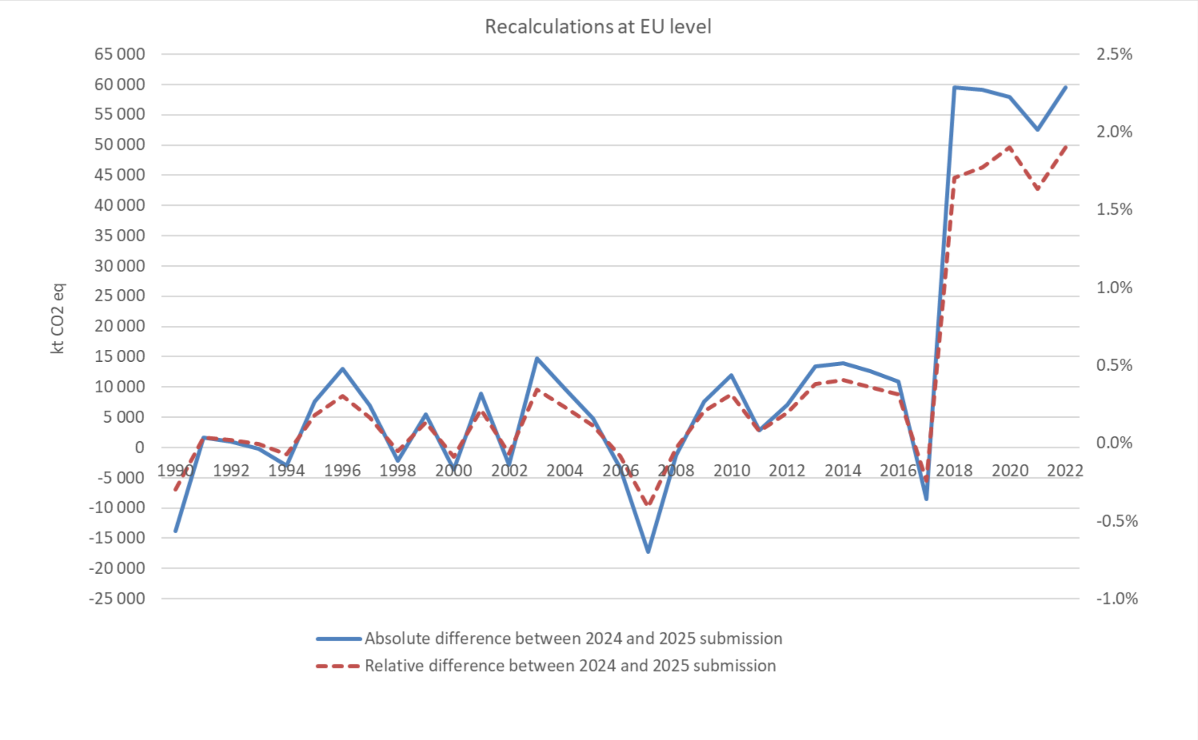
Note: Red marked are all Member State recalculations > +/- 5%

10.3 Implications for emission trends, including time series consistency

Figure 10.1 shows the absolute and relative difference in the 2024 and the 2025 submission for all years. From 1990 to 2017, recalculations have changed the overall emission trend only marginally by less than 0.5 %. But from 2018 onwards, the impact of recalculations increased significantly mainly due to recalculations in the LULUCF sector. The key reasons for the big recalculations in the LULUCF sector are the availability of new National Forest Inventory data for forest land (4.A), which led to substantial corrections of previously reported estimates in some MS, as well as better data for cropland with new and adjusted models for soil carbon together with more sample plots in both organic and mineral soils (4.B).

In the previous submission total EU GHG emissions (with LULUCF) decreased by 32.6 % between 1990 and 2022, and in the latest submission it decreased by 31.1% during the same time.

Figure 10.1: Absolute and relative difference of total EU GHG emission trends 1990–2022 (with LULUCF) between the latest and the previous submission



Note: Recalculations in this figure are based on EU National Totals. Recalculations in category 1A4 of Spain (Table 10.1.) are not reflected in this figure, as they only affect the sum of 1A4 but not the sector total or national total.

10.4 Recalculations, including in response to the review process, and planned improvements to the inventory

In 2024, the reporting has been amended to be in line with the new CRT reporting tables, as well as the NID outline. Descriptions of categories have been aligned accordingly. The report has been updated following the latest information available in Member State submissions. Any recommendations for improvement of earlier UNFCCC reviews have been continuously followed up and implemented.

In 2025, the transparency of the information in the EU NID has been further improved. In response to the in country, review of the EU GHG inventory in February 2025 several small adaptations/improvements have been implemented. The EU will continue to improve the transparency of its NID and provide more detailed information based on the recommendations included in the final review report, which was not available at the time of submission of this report.

The improvements made can be summarised as follows:

- Additional trend tables for each sector chapter included

- Further amendment of layout for figures to display emission trends in sectors
- Streamlining and harmonising of information provided in sectoral chapters
- New key categories included in the NID, giving detailed information like for other key categories

Improvements planned for the next reporting cycle are:

- Continue efforts to ensure consistency between CRT/JSON files and NID
- Continue efforts in harmonising the sectoral chapters and the content provided
- Continue the regular QA/QC activities and correct any possible inconsistencies detected

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12 UNITS AND ABBREVIATIONS

t	1 tonne (metric) = 1 megagram (Mg) = 10^6 g
Mg	1 megagram = 10^6 g = 1 tonne (t)
Gg	1 gigagram = 10^9 g = 1 kilotonne (kt)
Tg	1 teragram = 10^{12} g = 1 megatonne (Mt)
TJ	1 terajoule

AWMS	animal waste management systems
AD	activity data
BEF	biomass expansion factor
BKB	lignite briquettes
C	confidential
CAPRI	Common Agricultural Policy Regional Impact Assessment model (http://www.capri-model.org/)
CCC	Climate Change Committee (established under Council Decision No 280/2004/EC)
CH_4	methane
CO_2	carbon dioxide
COP	conference of the parties
CRF	common reporting format
CRT	common reporting tables
CV	calorific value
EC	European Community
EEA	European Environment Agency
EF	emission factor
Eionet	European environmental information and observation network
EMAS	Ecomanagement and Audit Scheme
ETC/CM	European Topic Centre on Climate Change Mitigation
ETF	Enhanced Transparency Framework

ETS	European Emissions Trading System
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GHG	greenhouse gas
GPG	good practice guidance and uncertainty management in national greenhouse gas inventories (IPCC, 2000)
GWP	global warming potential
HFCs	hydrofluorocarbons
JRC	Joint Research Centre
F-gases	fluorinated gases (HFCs, PFCs, SF_6)
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LULUCF	land-use, land-use change and forestry
MNP	Milieu-en Natuurplanbureau
MPG	Modalities, Procedures and guidelines
MS	Member State
MRG	monitoring and reporting guidelines
N	nitrogen
NH_3	ammonia
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	national forest inventory
NID	national inventory document
NIR	national inventory report
NO	not occurring
NUTS	Nomenclature of Territorial Units for Statistics
PFCs	perfluorocarbons
QA	quality assurance

QA/QC	quality assurance/quality control
QM	quality management
QMS	quality management system
RIVM	National Institute of Public Health and the Environment (The Netherlands)
SF_6	sulphur hexafluoride
SNE	Single National Entity
UNFCCC	United Nations Framework Convention on Climate Change
VOCs	Volatile Organic Compounds

Abbreviations in the source category tables in Chapters 3 to 9 and 18-24

Methods applied	**EF: methods applied for determining the emission factor**	**AD: methods applied for determining the activity data**	**Estimate: assessment of completeness**	**Quality: assessment of the uncertainty of the estimates**
CR — Corinair	CR — Corinair	AS — associations, business organizations	All — full	H — high
CS — country-specific	CS — country-specific	IS — international statistics	F — full	M — medium
COPERT X — Copert Model X = version	D — default	NS — national statistics	Full — full	L — low
D — default	M — model	PS — plant specific data	IE — included elsewhere	
M — model	MB — mass balance	Q — specific questionnaires, surveys	NE — not estimated	
NA — not applicable	PS — plant-specific	RS — regional statistics	NO — not occurring	
OTH - other				
RA — reference approach			P — partial	
T1 — IPCC Tier 1			Part — partial	
T1a — IPCC Tier 1a				
T1b — IPCC Tier 1b				
T1c — IPCC Tier 1c				
T2 — IPCC Tier 2				
T3 — IPCC Tier 3				