

Scope estimate update 2023

Estimate of 2005-2020 emissions for stationary installations to reflect fourth trading period scope (2021-2030) of the EU ETS



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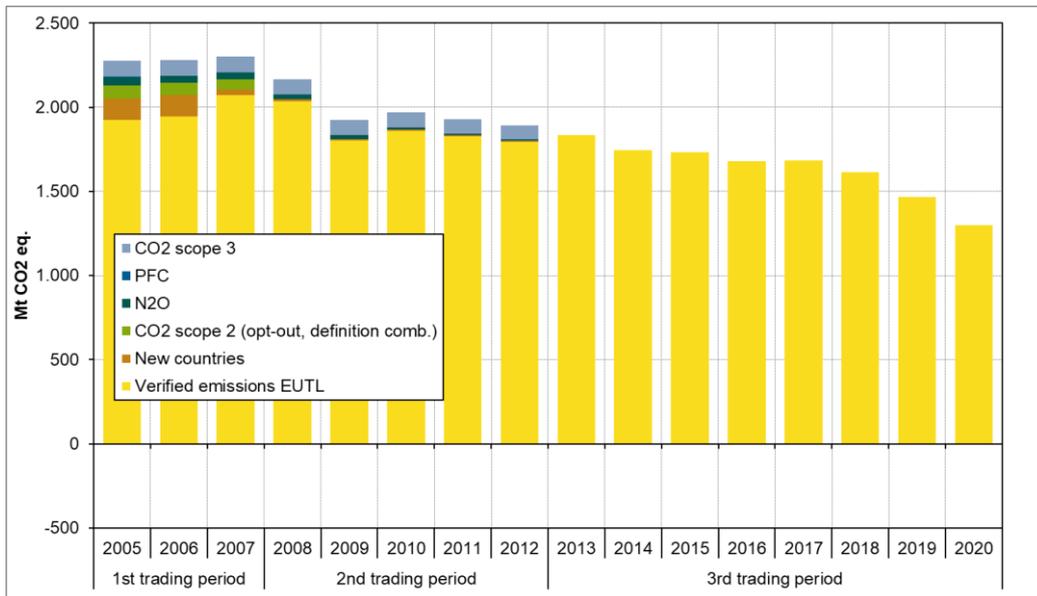
Executive summary

The EU Emission Trading Scheme (EU ETS) was launched in 2005 and has since been a cornerstone of EU climate policy. The EU ETS operates in trading periods, the first three of which ran from 2005 to 2007, 2008 to 2012 and 2013 to 2020. In 2021, the EU ETS entered its fourth trading period. The scope of the ETS in the third period was larger than in the first and second trading periods, as additional installations and gases became regulated under the scheme. With the fourth trading period the United Kingdom has ceased its participation in the scheme, only the installations in Northern Ireland continue to be covered. The global warming potentials are updated and small installations by several countries are excluded. A meaningful analysis of the development in ETS emissions over time and across trading periods needs to account for these changes in scope.

This paper presents a methodology for estimating the changes in scope that took place since its' introduction for each participating country. These scope estimates can be used to analyse emission developments over time and are used by the European Environment Agency (EEA) to complement the emissions data available from the European Union Transaction Log (EUTL).

The estimation is based on data from the ETS and the EU GHG inventory, EU legal documents, as well as data directly provided by Member States as outlined in the paper. The methods applied have different levels of uncertainty, which are also discussed in the paper. The resulting data set of scope estimates provides a basis for assessing emission trends in the EU ETS as a whole and at the national level over time⁽¹⁾. The resulting estimates for the period 2005-2020 represent upward adjustments to verified emissions from the EUTL, ranging from 15% of total emissions (including UK) in 2005, to -0.03% in 2020 (Figure ES-1).

Figure ES-1 Verified emissions and estimate of emissions to reflect the scope of the fourth trading period (2005–2020).

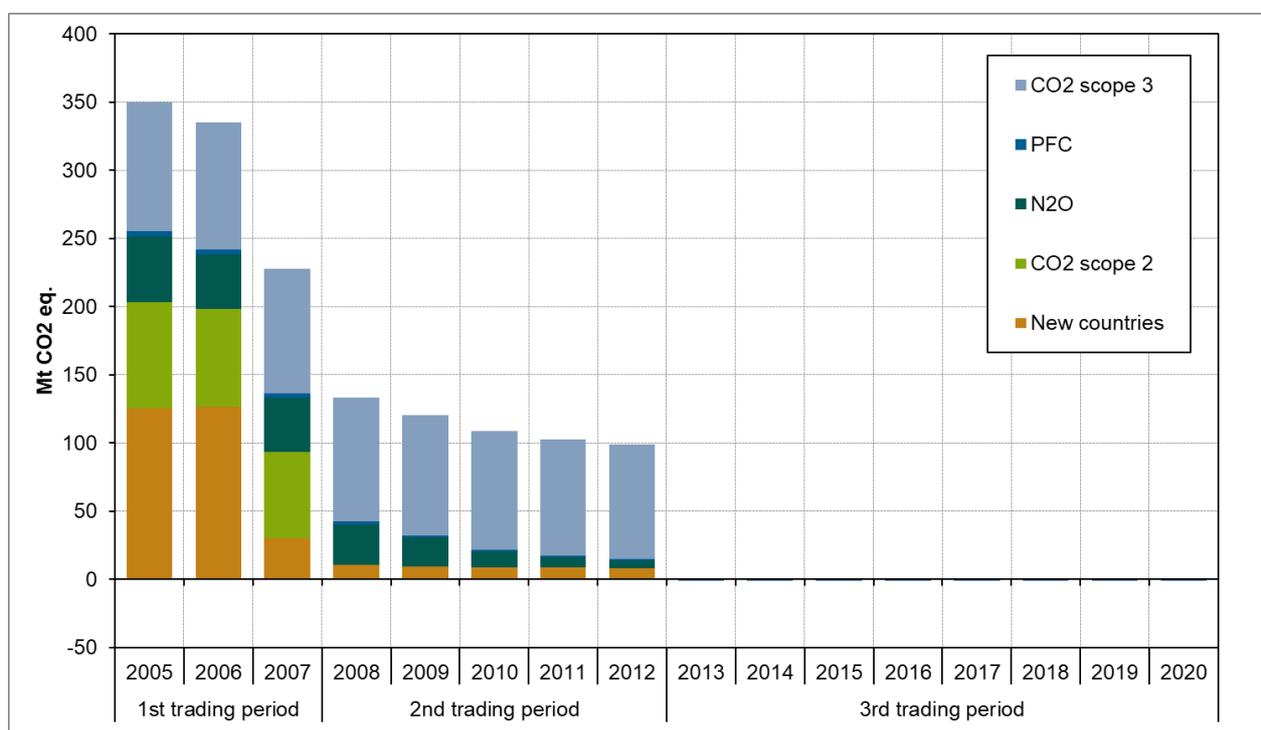


Source: ETC CM, 2023.

⁽¹⁾ The paper does not provide estimates at sector level as the level of uncertainty at sector level would have been significantly higher than at Member State level.

A list of changes in coverage need to be taken into account for calculating the scope estimate. The EU ETS began operating in 2005 covering CO₂ emissions from the EU-25 countries⁽²⁾. In 2007, Bulgaria and Romania joined the EU and its ETS. Installations from Liechtenstein and Norway entered the scheme at the start of the second trading period in 2008. At the same time, additional installations from already participating countries started to be covered by the scheme, due to the end of opt-outs and the clarification of the definition of combustion installations. At the start of the third trading period in 2013, stationary installations from Croatia and Iceland started to be covered by the EU ETS. At the same time, a range of new sectors and source categories were included, in particular N₂O emissions from the production of nitric and adipic acid, glyoxal and glyoxylic acid and PFC emissions from the production of aluminium. United Kingdom left the EU and terminated the participation in the EU ETS at the end of the third trading period. The global warming potentials are updated and small installations by several countries are excluded in the fourth trading period. The figure below shows the years of the first and second trading period in more detail, the (small) numbers in the third trading period are shown in the table of the end of the section.

Figure ES-2 Summary of emission estimates for 2005–2012 that can be applied to reflect the scope of the fourth trading period in each year.



Source: ETC CM, 2023.

The information on the size of the scope changes stems from a range of different data sources as highlighted in Figure ES-2:

- Data on emissions in ETS sectors in Liechtenstein and Norway before 2008 can be found in the respective National Allocation Plan (NAP) and compared to 2008 verified emissions from the EUTL.
- Data on emissions affected by the changes in scope between the first and second trading period (i.e. opt-outs and the clarification of the definition of combustion installations) stems from the process to determine annual allocation allowances (AEAs) under the ESD.

⁽²⁾ Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

- Data on additional emissions covered from non-CO₂ gases (i.e. N₂O and PFC) were taken from GHG inventories and converted to CO₂-equivalent units using global warming potential (GWP) values.
- Data on emissions from additional sectors and countries before their joining the EU ETS in 2013 is based on information from the Effort Sharing Regulation (ESR) and Effort Sharing Decision (ESD) target setting processes, which also includes information on emissions in the relevant sectors in Bulgaria and Romania before entering the EU ETS in 2007 and for Croatia that joined the EU ETS in 2013.

Three countries, Germany, Norway and Slovenia, have provided the authors with bottom-up emission estimates for 2005-2012 that can be used to reflect the scope of the third trading period. The national estimates are presented in Section 0, while the other sections derive estimates of emissions reflecting changes in scope also for these three countries based on the method outlined in Section 2.

Table ES-1 Estimates of emissions for changes in scope by country and year (Mt CO₂-eq).

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria	2.65	2.62	2.58	2.24	2.07	1.89	1.86	1.83	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01
Belgium	10.90	9.99	9.34	4.14	4.14	4.40	3.29	3.28	-0.05	-0.05	-0.03	-0.03	-0.04	-0.02	-0.02	-0.03
Bulgaria	37.87	37.93	1.85	1.80	1.52	1.49	1.44	1.33	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Croatia	12.36	12.39	13.52	12.58	11.07	10.44	10.39	9.51	-0.02	-0.03	-0.03	-0.01	-0.01	0.00	0.00	-0.01
Cyprus																
Czech Republic	3.58	3.44	3.27	3.19	3.01	2.85	2.85	2.81	-0.02	-0.03	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01
Denmark																
Estonia	0.25	0.25	0.25													
Finland	2.35	2.18	2.21	1.89	1.21	0.66	0.63	0.64	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
France	21.91	21.07	20.44	14.53	13.63	11.91	11.18	10.78	-0.08	-0.09	-0.09	-0.08	-0.15	-0.09	-0.08	-0.06
Germany	42.94	42.24	44.12	31.63	31.52	23.88	23.10	22.48	-0.09	-0.08	-0.08	-0.08	-0.08	-0.07	-0.06	-0.06
Greece	2.37	2.25	2.22	2.18	2.08	2.11	2.13	1.97	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Hungary	3.16	2.65	2.21	0.00	0.01	0.01	0.01	0.02	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Iceland	1.78	2.08	2.00	2.04	1.80	1.77	1.65	1.64	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Ireland	0.34	0.34	0.33	0.37	0.36	0.35	0.35	0.34								
Italy	20.67	16.14	15.42	8.57	8.54	7.93	7.28	7.04	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Latvia	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02								
Liechtenstein	0.02	0.02	0.02													
Lithuania	4.67	4.64	5.18	4.91	2.95	2.84	3.06	2.77	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
Luxembourg	0.32	0.31	0.31	0.30	0.30	0.29	0.29	0.28								
Malta																
Netherlands	10.55	10.44	9.35	1.62	1.57	1.58	1.59	1.49	-0.03	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.02
Norway	25.13	25.06	25.23	5.70	4.81	4.57	4.52	4.39	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02
Poland	17.65	17.49	17.50	11.77	8.99	8.89	8.66	8.62	-0.06	-0.05	-0.05	-0.06	-0.05	-0.05	-0.04	-0.04
Portugal	1.91	1.89	1.90	1.08	0.93	0.95	0.66	0.63	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Romania	70.43	70.22	8.65	7.13	6.66	7.01	6.90	6.63	-0.05	-0.04	-0.03	-0.03	-0.03	-0.02	-0.01	-0.01
Slovakia	3.68	3.94	3.77	1.89	1.67	1.50	1.07	0.96	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Slovenia	-0.05	-0.057	-0.09	-0.16	-0.16	-0.16	-0.15	-0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spain	16.69	10.07	9.62	9.29	9.02	8.53	8.17	7.91	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.02
Sweden	3.89	3.86	3.66	1.94	1.68	1.80	1.57	1.44	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
United Kingdom	31.92	31.45	23.14	2.41	1.23	1.38	0.32	0.14	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01
EU-27	291.10	307.78	200.76	125.33	114.01	102.56	96.68	92.79	-0.57	-0.55	-0.53	-0.47	-0.52	-0.44	-0.38	-0.34
All countries	349.95	334.94	228.00	133.07	120.62	108.90	102.85	98.82	-0.62	-0.60	-0.58	-0.52	-0.56	-0.49	-0.43	-0.38

National figures								
Germany	38.96	38.76	42.33	32.00	29.29	24.75	23.96	23.19
Norway	26.48	25.96	27.27	7.20	5.02	6.14	5.92	5.99
Slovenia	0.00	-0.02	-0.01	-0.11	-0.13	-0.13	-0.06	-0.03

Source(s): ETC-CM, 2023.

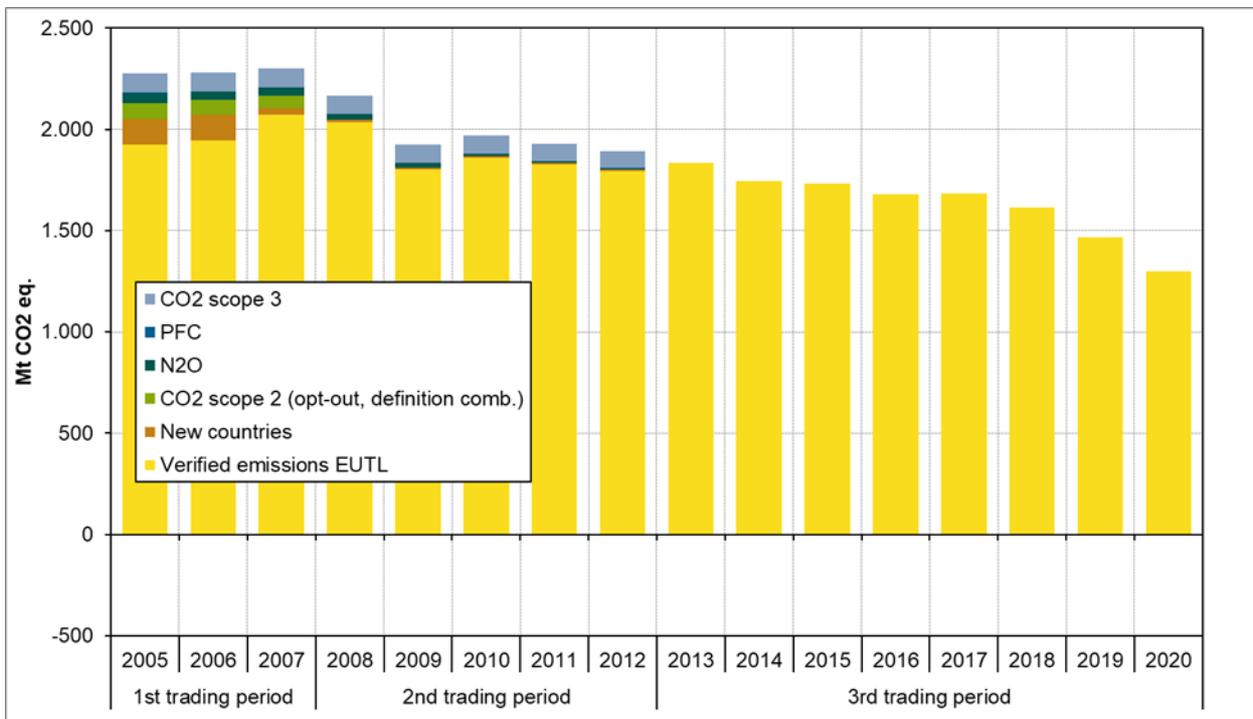
1 Introduction

Since the start of the EU ETS in 2005, the number of installations and gases covered has constantly changed due, for example, to the inclusion of new countries, gases or sectors. This paper describes the process of estimating a consistent time series of emissions that reflects successive changes in the scope of the ETS Directive for stationary installations.

For each year from 2005 to 2020, we estimate the emissions that would have been covered had the scope of the fourth trading period already been applied then. We estimate these emissions for each year and for each participating country. The paper does not address changes related to the inclusion or exclusion of individual installations within trading periods (e.g. new entrants and closures). Throughout this paper, all numbers shown refer to stationary installations.

The estimate of emissions to reflect the fourth trading periods' scope has many possible uses. Most importantly, it allows a meaningful comparison of verified emissions under the EU ETS across years. Comparing verified emissions as published on the EUTL between 2005 and 2020, implies a reduction of only 33% across this timeframe. With the addition of the estimated emissions to reflect the current ETS scope the reduction is estimated to be around 43% (Figure 1-1).

Figure 1-1 Verified emissions and estimated emissions in historical years to reflect the scope of the third trading period (2005–2020).



Source: ETC-CM, 2023.

A fully consistent time series of ETS emissions between 2005 and 2022 is of interest to a whole range of stakeholders including policy makers, regulators, researchers, and the interested public. Estimates have been available on the EEA’s EU ETS data viewer since 2013. A first version of the described improved methodology and its results has been tested in the [EEA EU ETS data viewer](#) (EEA 2023b) since May 2015

and been consulted with Member State experts during 2015. In 2021, at the beginning of the fourth EU ETS trading period the scope was again altered slightly. This is reflected in this update of the scope estimate.

2 Estimation approach

The scope of the EU ETS has been modified several times since its inception. In particular:

- The EU ETS began operating in 2005 covering only CO₂ emissions from large point sources in EU-25 countries⁽³⁾.
- In 2007, Bulgaria and Romania joined the EU and its ETS.
- Installations from Liechtenstein and Norway entered the scheme at the start of the second trading period in 2008. At the same time, additional installations and emissions from already participating countries started to be covered by the scheme, due to the end of opt-outs and to the clarification of the definition of combustion installations. N₂O emissions were included as opt-in in several countries.
- At the start of the third trading period in 2013, installations from Croatia and Iceland started to be covered by the EU ETS. At the same time, a range of new sectors and source categories were included, in particular N₂O and PFC emissions.
- In 2020, the United Kingdom left the EU ETS. The global warming potentials to convert N₂O and PFC emissions to CO₂ equivalents are updated. Several countries used the option to exclude additional small installations.

For each of these changes in scope, different options exist regarding the method for estimating historical emissions at trading period four scope of the EU ETS. The choice of the best option depends on data and resource availability and the expected magnitude of the activities and sectors for which an estimate needs to be made compared to total emissions covered.

⁽³⁾ Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 2-1 Potential data sources and their availability.

	Type of data source	Options and considerations
1	Historical data at installations level	The European Pollutant Release and Transfer Register (E-PRTR) was explored as a data source containing historical information at installation level. This database has, however, a number of shortcomings that make it infeasible for the present exercise: i) E-PRTR data is only available from 2007 onwards, making the 2005-2012 time series incomplete; ii) not all (new) ETS installations can be consistently identified in this database; and iii) data quality is uncertain, because (contrary to ETS emissions), the data entered are not verified.
2	Historical data at sector level	A source for this type of data are the national GHG inventories officially submitted under the UNFCCC. These data are subject to an external review process. However, the categories used in the GHG inventories (based on the UNFCCC's common reporting format (CRF)) are not strictly comparable with the activity types reported by individual installations and one ETS installation may cause emissions that are reported in several inventory categories. Thus, a fully consistent mapping of ETS sectors to CRF categories is not possible without additional knowledge on installation level. ETS emissions can be estimated as inventory emissions multiplied with the share of ETS in inventory emissions in other years. However, it should be kept in mind that inventory figures are revised retroactively whenever the underlying methodologies related to the data are changed, therefore emission estimates for the past might be subject to change.
3	Data used in legislative processes (directives, regulations, impact assessments)	This category encompasses data used in the ESR target setting process or data contained in the National Allocation Plans (NAPs). This kind of data is useful, since it directly identifies relevant installations and / or sectors. However, some of the data may not be accessible, information may not be available for the whole time series and the data may include also other factors than historical emissions data alone. In case information on individual years is missing, it can be (linearly) interpolated.
4	Back-casting of more recent emissions data	If no historic emissions data is available, assumptions have to be made that allow back-casting of more recent (available) emissions data. Inventory data and ETS shares may again be used for this back-casting exercise.

The most important data source underpinning the scope estimates are data on historical emissions. In general, four approaches depending on the availability and quality of these data can be distinguished (Table 2-1). Based on these considerations, the estimate of emissions to reflect fourth trading period ETS scope presented in this paper rely on a mix of approaches 2 and 3. In some cases, inventory emissions were used to back-cast recent emissions data (approach 4).

The remainder of the paper is structured as follows. In a first step, an estimate of emissions is built to reflect the scope of the second trading period. Then the effect of the inclusion of additional gases is estimated. In a third step the scope estimate for CO₂ emissions in the third and fourth trading periods are described. In the final section information provided by Germany, Norway and Slovenia on bottom-up calculations of scope estimates for the respective country is presented. Detailed scope estimates by country can be found in the Annex.

3 Estimate to reflect the scope of the second trading period

The EU ETS began operating in 2005 covering CO₂ emissions from large point sources in EU-25 countries. In 2007 and 2008 four new countries joined the scheme. With the start of the second trading period additional installations and emissions from already participating countries were additionally covered by the scheme. The scope estimate for new countries is presented first in the section below, then the changes in EU-25 countries are described.

3.1 Additional countries entering the EU ETS

The estimate of emissions at current ETS scope has to take into account that four countries joined the EU ETS between 2005 and 2012, namely Bulgaria and Romania (2007), Norway and Liechtenstein (2008).

3.1.1 Bulgaria and Romania

For **Bulgaria and Romania**, verified emissions are available from the EUTL for the years from 2007 onwards. To estimate 2005 and 2006 ETS emissions, inventory emissions and the share of ETS emissions in CO₂ emissions in relevant inventory categories in subsequent years is used (approach 2) as no installation specific data could be found.

The main CRF categories in which ETS emissions occur are identified based on ETS shares given in Annex V under Article 10 of the Implementing Regulation (EC 2014). These are:

- 1.A.1 (fuel combustion by energy industries),
- 1.A.2 (fuel combustion by manufacturing and construction industries),
- 2.A (industrial processes for mineral production)
- 2.B (industrial processes by chemical production) and
- 2.C (industrial processes for metal production)⁽⁴⁾.

For the sum of these categories, the share of ETS emissions (available from the EUTL from 2007 onwards) in those inventory emissions is calculated. It can be seen that the share of ETS emissions in the relevant inventory emissions is relatively stable over the years.

Table 3-1 Estimated emissions for Bulgaria and Romania to reflect the scope of the second trading period.

Bulgaria	2005	2006	2007	2008	2009	2010	2011	2012	Average 07-09
Inventory emissions (1.A.1, 1.A.2, 2.A, 2.B, 2.C) (Mt CO ₂ e)	40.5	41.0	45.3	43.4	35.6	37.7	42.5	37.4	41.4
ETS verified emissions (Mt CO ₂ e)			39.2	38.3	32.0	33.5	40.0	35.1	36.5
Share ETS in relevant inventory emissions (%)			87%	88%	90%	89%	94%	94%	88%
Estimate based on average 07-09 share (Mt CO ₂ e)	35.7	36.2							

⁽⁴⁾ Other source categories are also mentioned in this Annex but these are minor with regard to ETS emissions from stationary installations.

Romania	2005	2006	2007	2008	2009	2010	2011	2012	Average 07-09
Inventory emissions (1.A.1, 1.A.2, 2.A, 2.B, 2.C) (Mt CO ₂ e)	75.5	76.0	81.9	80.2	62.2	60.6	67.0	64.0	74.8
ETS verified emissions (Mt CO ₂ e)			69.6	63.8	49.1	47.3	51.2	47.9	60.8
Share ETS in relevant inventory emissions (%)			85%	80%	79%	78%	76%	75%	81%
Estimate based on average 07-09 share (Mt CO ₂ e)	61.2	61.7							

Source: GHG emissions inventory as of June 2023 from EEA (2023a). ETS verified emissions as of June 2023 from EEA (2023b).

The average share of three years (2007, 2008 and 2009) is then multiplied with the relevant 2005 and 2006 inventory emissions. The choice of an average share for 2007–2009 is preferred here to the share in 2007 only, in order to avoid the potential impact of special circumstances in that year (e.g. weather conditions).

The table provides an overview of the data used, as well as the estimated CO₂ emissions from ETS sectors for Romania and Bulgaria for the missing years 2005 and 2006.

3.1.2 Norway and Liechtenstein

For **Norway and Liechtenstein**, verified emissions are available from the EUTL for the years from 2008 onwards. In addition, information on actual 2005 emissions of ETS installations is available from the respective national allocation plans (NAPs) (Liechtenstein 2008; Norway 2008). Assuming that the NAP information for 2005 depicts the situation of ETS installations in that year better than an estimate based on inventory shares, this data was used (approach 3). 2006 and 2007 CO₂ emissions are calculated by linear interpolation between 2005 and 2008 emissions.

Since Norway opted-in N₂O-emitting installations in July 2008, 2008 verified emissions from the EUTL combine CO₂ for the whole year and N₂O emissions for the second half of 2008. 2008 CO₂ emissions are therefore estimated by deducting 50% of 2008 N₂O emissions reported in the national GHG inventory (for source categories 2.B.2. Nitric acid production and 2.B.3. Adipic acid production) from 2008 EUTL emissions⁽⁵⁾. The following years are shown for information purpose only – in these years 100% of N₂O emissions are deducted as installations reported N₂O emissions for the full year. The estimate for N₂O emissions (related to the change between second and third trading period) is carried out in a separate step.

Table 3-2 Estimated emissions for Liechtenstein and Norway to reflect the scope of the second trading period (all figures in Mt CO₂e).

Norway	2005	2006	2007	2008	2009	2010	2011	2012
ETS verified emissions				19.3	19.2	19.3	19.1	18.6
N ₂ O emissions in ETS based on inventory (2.B.2, 2.B.3)				0.4	0.4	0.3	0.2	0.2
Emissions data from NAP process	17.8							
ETS emissions without N ₂ O				18.9	18.8	19.0	18.8	18.3
Resulting scope estimate based on interpolation	17.8	18.2	18.6					

⁽⁵⁾ Norway reports in the GHG inventory (2015) that emissions from glyoxal and glyoxylic acid are not occurring.

Liechtenstein	2005	2006	2007	2008	2009	2010	2011	2012
ETS verified emissions				0.020	0.013	0.002	0.002	0.001
Emissions data from NAP process	0.018							
Resulting scope estimate based on interpolation	0.018	0.019	0.019					

Source: Norway (2008); Liechtenstein (2008); GHG emissions inventory as of June 2023 from EEA (2023a). ETS verified emissions as of June 2023 from EEA (2023b).

As outlined in the overall approach; it is preferable to use bottom-up installation specific data where available. The Norwegian Environment Agency provided the authors with national figures that are used in the further EEA work when an estimate of historical emissions at current ETS scope is required (see Chapter 6). Therefore, the information on Norway contained in this section is for informational purposes only.

3.2 Opt in, opt outs and clarified definition of combustion installations

The scope of participating installations changed between the first and second trading periods of the EU ETS in a number of participating countries for two main reasons: opt outs and clarified definition of combustion installations. Other – in terms of emissions less important – reasons for changes included the creation of de-minimis rules (i.e. rules for exclusion of small installations) and the exclusion of temporary opt-ins.

Opt outs in 2007-2009

The previous version of article 27 of the ETS Directive allowed Member States to temporarily exclude certain installations of the ETS during the first trading period. Opt-out was allowed only if the concerned installations were subject to emission reductions, monitoring and reporting rules and penalties similar to those under the EU ETS.

In the United Kingdom, some installations participating in the UK emissions trading scheme entered the EU ETS in 2007. They were opted-out of the EU ETS in 2005 and 2006 (DECC 2009). In Belgium and the Netherlands, some installations were opted out during the first trading period and entered the EU ETS in 2008.

Definition of combustion installations

For the second trading period, the European Commission clarified the definition of combustion installations to be covered by the EU ETS (EC 2005)⁽⁶⁾. This clarification was released to increase harmonisation of included combustion installations across the EU⁽⁷⁾. In particular, the following activities were to be included as combustion installations by all participating countries from the second trading period onwards.

- Flaring activities including those at offshore installations;
- Combustion processes involving crackers at petrochemical installations;
- Combustion processes for the production of carbon black;
- Furnaces including rock wool production furnaces;
- Integrated steelworks including rolling mills, re-heaters, annealing furnaces and pickling;

⁽⁶⁾ Also for installations in the ceramics sector a clarification regarding the thresholds that warranted inclusion in the scheme were made. Ceramics installations were included based on capacity or production thresholds during the first trading period. From 2008 onwards, the definition was clarified so that ceramic installations had to exceed both thresholds.

⁽⁷⁾ Point 36 of COM (2005)703 final, as clarified by the “co-ordinated definitions of additional combustion installations” contained in the minutes of the Climate Change Committee of 31 May 2006.

- Installations for the production of ethylene and propylene with production capacity of > 50,000 tons per year.

From 2005 to 2007, some Member States applied a ‘narrow’ definition of combustion installations and did not include all or some of the types of installations listed above, while other Member States used a ‘broad’ definition and included these emissions in their reporting of verified emissions under the EU ETS. The following 16 Member States extended the scope of ETS installations due to this clarification: Austria, Belgium, Germany, Estonia, Finland, France, Hungary, Italy, Lithuania, the Netherlands, Poland, Portugal, Sweden, Slovakia, Spain and the United Kingdom. In Spain, the broader definition of covered installation was applied already from 2006 onwards (Real Decreto Ley 5/2005 2005), while for all other listed Member States, the broader definition was used from 2008 onwards.

De-minimis rules or temporary opt-ins

The introduction of de-minimis rules (defining a minimum size of installations for their inclusion in the EU ETS) and the temporary inclusion in the ETS of certain installations during the first trading period resulted in the exclusion of these installations from the ETS in the second trading period, e.g. in the UK.

Data source

Emission data for the installations concerned by the changes in ETS scope described above were provided by Member States for the purpose of determining AEAs under the ESD (EC 2013). In particular, information on 2005 emissions data was made available for all those installations that entered the ETS due to the termination of opt-outs and the clarification of the definition of combustion installations.

The estimated emissions to reflect the scope of the 2nd trading period for the years 2006 and 2007 is assumed to be equal to the 2005 estimate⁽⁸⁾ for all countries except Spain and the United Kingdom (UK). For Spain, the new definition of combustion installations was applied from 2006 onwards; therefore no estimate of emissions is necessary for 2006 and 2007. For the United Kingdom, the opt-out of installations covered by the UK ETS ended at the end of 2006, therefore no estimate of emissions for the opt-out of installations is necessary for 2007. The resulting estimates of emissions to reflect the scope of the 2nd trading period are presented in

Table 3-3 for all EU-25 Member States as estimates for those countries which entered as a later point of time have been catered for separately.

Table 3-3 Estimated emissions to reflect the scope of the second trading period for countries participating since 2005 (MT CO₂).

	2005	2006	2007
Austria	0.35	0.35	0.35
Belgium	5.19	5.19	5.19
Estonia	0.25	0.25	0.25
Finland	0.40	0.40	0.40
France	4.71	4.71	4.71
Hungary	1.43	1.43	1.43
Ireland	-0.04	-0.04	-0.04
Italy	5.92	5.92	5.92
Lithuania	0.06	0.06	0.06
Netherlands	3.92	3.92	3.92
Poland	4.95	4.95	4.95
Portugal	0.77	0.77	0.77

⁽⁸⁾ This assumption was taken as for the majority of ETS countries emissions remained quite stable within the first trading period with variation below 5% of the trading period’s average.

Slovakia	1.79	1.79	1.79
Spain	6.22		
Sweden	1.67	1.67	1.67
United Kingdom	29.15	29.15	20.55
EU-27	48.60	42.37	42.37
All countries	77.75	71.52	62.92

Source: Communication between Commission and Member States to determine annual emission allocations under the Effort Sharing Decision; DECC (2009); Real Decreto Ley 5/2005 (2005).

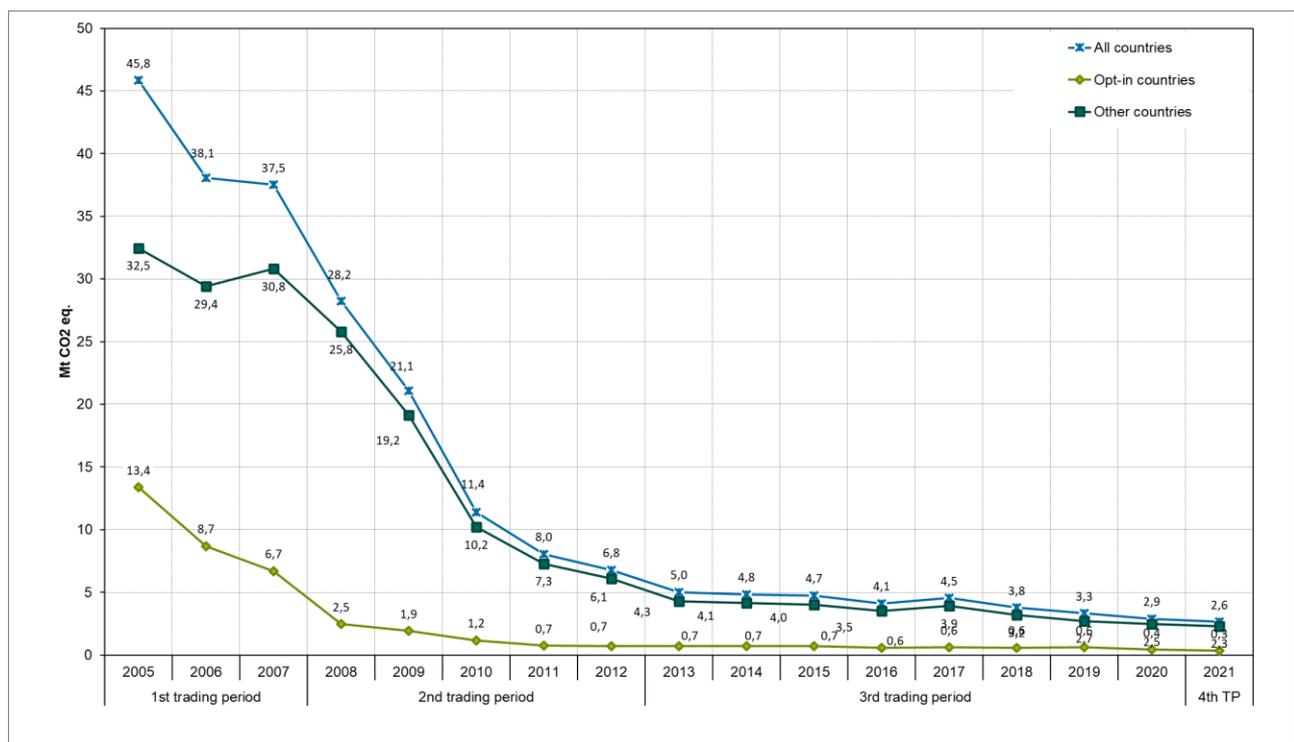
4 Estimate to reflect inclusion of non-CO₂ gases

At its start the EU ETS was limited to CO₂ emissions. With the third trading period N₂O emissions from the production of certain chemicals and PFC emissions related to the production of primary aluminium are covered. Based on information from the GHG inventories we estimate the emissions from those activities if they had been covered from the start. To make those emissions comparable to CO₂ emissions global warming potentials (GWP) are used to convert them to CO₂ equivalents. The GWPs used have been different between trading periods.

4.1 N₂O emissions from the production of certain chemicals

Since 2013, the EU ETS covers N₂O emissions from the production of nitric and adipic acid as well as glyoxal and glyoxylic acid in all participating countries. Even before 2013, a number of countries had decided to opt-in installations emitting N₂O. The relevant inventory categories are summed up to estimate N₂O emissions from those activities that are since 2013 covered by the EU ETS in the years 2005-2012 (Figure 4-1). We use AR5 GWPs to convert N₂O and PFC emissions to CO₂ equivalents (European Commission 2020).

Figure 4-1 Inventory emissions related to the production of adipic and nitric acid, glyoxal and glyoxylic acid.



Source: GHG emissions inventory from EEA (2023a) and United Kingdom (2023).

Note: AR5 GWPs are used to convert N₂O emissions into CO₂-eq.

In 2005, N₂O emissions from adipic acid, nitric acid, glyoxal and glyoxylic acid production for the EU ETS countries (including United Kingdom) stood at 48 Mt CO₂-eq. In 2013, these emissions had decreased by 90%, down to 5 Mt CO₂-eq. Reductions in N₂O emissions were even steeper in those countries which opted in these activities during the second trading period (i.e. Austria, Italy, Netherlands, Norway, and the United Kingdom), with an average 95% decrease between 2005 and 2013.

This steep decline in emissions can be attributed to the implementation of relatively cheap abatement options, especially in nitric acid production, as many catalysts were installed at the end of the year 2008 or in 2009 – many of them through JI projects. For adipic acid production, a first decline in emissions already started earlier (around 1997), but emissions have since declined further (ETC/ACC 2010).

Table 4-1 shows our estimation of historical emissions at current ETS scope for N₂O emissions between 2005 and 2012. For countries that did not opt-in N₂O emitting installations, these are equal to the emissions reported under the above-mentioned inventory categories (2.B.2., 2.B.3., 2.B.4.b und 2.B.4.c).

For those countries that did opt-in N₂O emitting installations already during the second trading period, inventory information is used as described above for the years prior to the opt-in. This is relevant for Austria (before 2010), Italy (before 2011), the Netherlands (before 2008), Norway (before 2008) and the United Kingdom (before 2011)⁽⁹⁾. For opt-in countries, the estimate reflects that installations were often not opted in on the 1st of January of the first year, but e.g. in April (Italy, UK) or July (Norway). This calculation leads to positive scope estimate values during the first opt-in year for the relevant countries in some cases (e.g. Norway in 2008 or the UK in 2011).

The estimate further needs to consider the fact that during the second trading period of the EU ETS (2008-2012), GWP factors consistent with the IPCC's Second Assessment Report (SAR) were used to convert N₂O emissions to CO₂ equivalents. In order to be consistent with the remaining calculations of this report and current EU ETS practice, emissions from N₂O need to be adjusted for the difference between SAR GWPs and AR5 GWPs (i.e. 310 vs. 265). This calculation leads to (small) negative values in the scope estimate for opt-in countries after the opt-in happened.

Since 2013 N₂O emissions are covered for all countries. During the third trading period (2013-2020) AR4 global warming potentials were applied to report N₂O emissions as CO₂eq. As for opt-in countries in the 2nd trading period an adjustment is applied to account for the difference between AR4 and AR5 GWPs (i.e. 298 vs. 265).

⁽⁹⁾ Refer to Commission decisions on applications to include additional gases and installations available at http://ec.europa.eu/clima/policies/ets/pre2013/nap/documentation_en.htm.

Table 4-1 Estimate of historical emissions at 4th trading period scope for N₂O (Mt CO₂-eq).

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria	0.234	0.239	0.231	0.279	0.141	-0.008	-0.006	-0.007	-0.005	-0.005	-0.005	-0.004	-0.004	-0.006	-0.008	-0.005
Belgium	2.617	1.759	1.160	1.202	1.248	1.555	0.496	0.536	-0.053	-0.045	-0.034	-0.029	-0.037	-0.025	-0.022	-0.027
Bulgaria	0.781	0.419	0.518	0.496	0.233	0.229	0.200	0.112	-0.012	-0.012	-0.012	-0.011	-0.009	-0.011	-0.008	-0.008
Croatia	0.566	0.560	0.617	0.631	0.528	0.680	0.670	0.580	-0.024	-0.026	-0.031	-0.011	-0.010	-0.005	-0.005	-0.006
Czech Republic	0.790	0.702	0.575	0.535	0.403	0.289	0.329	0.337	-0.021	-0.025	-0.028	-0.021	-0.013	-0.011	-0.009	-0.007
Finland	1.389	1.229	1.264	1.349	0.678	0.142	0.115	0.142	-0.021	-0.020	-0.025	-0.021	-0.023	-0.021	-0.020	-0.022
France	5.244	4.709	4.426	3.767	3.115	1.552	0.963	0.708	-0.074	-0.084	-0.085	-0.073	-0.144	-0.087	-0.071	-0.054
Germany	7.125	6.964	9.236	8.083	8.431	1.235	0.900	0.678	-0.081	-0.074	-0.075	-0.069	-0.069	-0.064	-0.055	-0.056
Greece	0.467	0.378	0.376	0.361	0.314	0.366	0.406	0.262	-0.002	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Hungary	1.482	1.222	0.774	0.004	0.013	0.009	0.014	0.019	-0.004	-0.006	-0.005	-0.003	-0.005	-0.004	-0.003	-0.003
Italy	6.634	2.262	1.616	0.911	0.966	0.553	0.036	-0.029	-0.022	-0.011	-0.014	-0.011	-0.014	-0.012	-0.012	-0.012
Lithuania	2.063	2.070	2.660	2.485	0.562	0.494	0.757	0.510	-0.033	-0.033	-0.025	-0.021	-0.022	-0.017	-0.018	-0.015
Netherlands	4.837	4.784	3.680	-0.069	-0.061	-0.037	-0.030	-0.033	-0.027	-0.035	-0.036	-0.027	-0.029	-0.028	-0.029	-0.020
Norway	1.672	1.391	1.177	0.341	-0.057	-0.044	-0.036	-0.035	-0.026	-0.027	-0.025	-0.024	-0.021	-0.020	-0.018	-0.010
Poland	3.739	3.714	3.866	3.245	0.744	0.784	0.693	0.790	-0.062	-0.048	-0.051	-0.060	-0.046	-0.050	-0.045	-0.038
Portugal	0.496	0.488	0.508	0.465	0.328	0.353	0.080	0.059	-0.005	-0.005	-0.004	-0.002	-0.004	-0.005	-0.004	-0.003
Romania	2.650	2.109	2.369	0.962	0.604	1.055	1.052	0.888	-0.050	-0.040	-0.033	-0.034	-0.025	-0.023	-0.012	-0.009
Slovakia	1.098	1.354	1.212	1.124	0.933	0.773	0.360	0.258	-0.013	-0.014	-0.014	-0.012	-0.010	-0.010	-0.009	-0.007
Spain	1.581	1.330	1.034	0.844	0.765	0.431	0.221	0.138	-0.018	-0.017	-0.017	-0.017	-0.013	-0.015	-0.015	-0.013
Sweden	0.376	0.391	0.209	0.229	0.260	0.267	0.035	0.058	-0.005	-0.005	-0.004	-0.005	-0.004	-0.003	-0.003	-0.001
United Kingdom	2.518	2.022	2.353	2.143	1.022	1.125	0.025	-0.005	-0.004	-0.004	-0.003	-0.002	-0.004	-0.002	-0.004	-0.005
EU-27	44.17	36.68	36.33	26.90	20.21	10.72	7.29	6.01	-0.53	-0.51	-0.50	-0.43	-0.48	-0.40	-0.35	-0.31
All countries	48.36	40.10	39.86	29.39	21.17	11.80	7.28	5.97	-0.56	-0.54	-0.53	-0.46	-0.51	-0.42	-0.37	-0.32

Source: GHG emissions inventory from EEA (2023a) and United Kingdom (2023), own calculations.

Note: Only countries reporting N₂O emissions in the relevant inventory categories are shown. For Austria, Italy, the Netherlands, Norway and the United Kingdom the years with opt-in of N₂O emissions are marked in grey. AR5 GWP potentials are used to convert N₂O into CO₂-eq emissions.

4.2 PFC emissions from the production of aluminium

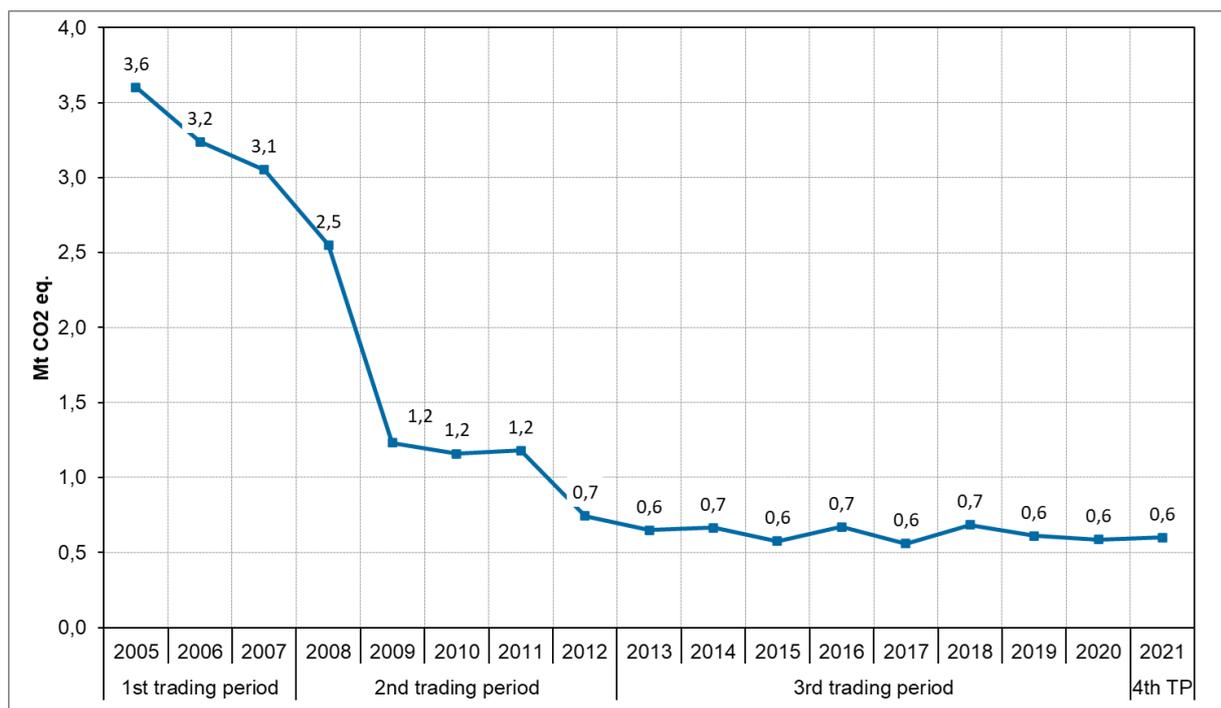
For PFC emissions from the production of aluminium, a similar trajectory as for N₂O emissions can be observed in GHG inventories (Figure 4-2). Overall, 2013 emissions were 82% lower than in 2005. One reason for this steep decline is a reduction in PFC emissions due to process optimisation.

Similar to N₂O emissions, the estimate of historical emissions for PFC is carried out using information from the inventory in the source category 2.C.3. (Aluminium production). Since opt-in of PFC emissions was not applied in the second trading period, no differentiation between Member States is necessary in this case.

There has been a change in the GWPs used for PFC between the third and the fourth trading period, too. PFC emissions from aluminium production are reported in the inventory as a sum, albeit they consist of two gases according to the monitoring and reporting regulation: PFC-14 (chemical formula CF₄) and PFC-116 (C₂F₆) (European Commission 2020). For both gases the new AR5 GWPs are lower than the AR4 GWPs (-9% and -10.3% respectively). We use the average (-9.7%) to calculate the scope estimate for the third trading period; this value is confirmed by GHG inventory data from 2020 available to the EEA based on AR4 and on AR5.

Table 4-2 shows estimates for all countries reporting PFC emissions in their inventory.

Figure 4-2 Inventory emissions related to the production of aluminium.



Source: GHG emissions inventory from EEA (2023a) and United Kingdom (2023), own calculations.

Note: AR5 GWPs are used to convert PFC emissions into CO₂-eq.

Table 4-2 Estimate of historical emissions at fourth trading period scope for PFC (Mt CO₂-eq).

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	0.75	0.63	0.46	0.09	0.03	0.05	0.09	0.12	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.01
Germany	0.35	0.20	0.20	0.26	0.19	0.14	0.09	0.08	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Greece	0.05	0.04	0.04	0.05	0.02	0.04	0.04	0.05	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Hungary	0.25															
Iceland	0.03	0.35	0.30	0.37	0.16	0.15	0.07	0.08	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Italy	0.19	0.16	0.21	0.12	0.15	0.09	0.09	0.03								
Netherlands	0.09	0.06	0.10	0.08	0.05	0.06	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norway	0.86	0.77	0.85	0.81	0.39	0.21	0.24	0.18	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01
Poland	0.15	0.16	0.15	0.13												
Romania	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slovakia	0.02	0.04	0.03	0.04	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slovenia	0.13	0.12	0.09	0.01	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spain	0.19	0.18	0.17	0.16	0.11	0.09	0.08	0.05	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00
Sweden	0.36	0.34	0.35	0.30	0.04	0.17	0.19	0.07	0.00	-0.01	0.00	0.00	0.00	-0.01	0.00	-0.01
United Kingdom	0.10	0.13	0.09	0.12	0.06	0.12	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU-27	2.61	1.98	1.81	1.25	0.61	0.67	0.71	0.47	-0.04	-0.04	-0.03	-0.04	-0.04	-0.05	-0.03	-0.03
All countries	3.60	3.24	3.05	2.55	1.23	1.16	1.18	0.74	-0.06	-0.06	-0.06	-0.06	-0.05	-0.07	-0.06	-0.06

Source: GHG emissions inventory from EEA (2023a) and United Kingdom (2023), own calculations.

Note: Only countries reporting PFC emissions are shown. AR5 GWPs are used to convert PFC emissions into CO₂-eq.

5 Scope estimate for CO₂ to reflect the scope of the third and fourth trading periods

5.1 CO₂ emissions in the scope of the third trading period

From 2013 onwards, the scope of the EU ETS was not only enlarged by the inclusion of new gases, but also by additional CO₂ emissions. The estimate of historical emissions for CO₂ emissions relies on the overall ETS cap adjustment determined by the Commission (covering all gases), related to the change from the second to the third trading period (EC, (2013)). The adjustment is reported for the sum of all three gases N₂O, PFC and CO₂ only, once using the global warming potentials from the second assessment report by IPCC (EC, (2013), Annex I) and once using GWP from the fourth assessment report (Annex II). In order to avoid correcting twice for N₂O and PFC, we aim to deduct the estimated historical emissions for N₂O and PFC from the overall amount to single out the estimate for CO₂ emissions. For the EFTA countries the AEA adjustment figures are based on the decisions of the EEA Joint Committee (2012).

There are four groups of countries:

1. Countries without an estimate of historical emissions for N₂O or PFC: The amounts given in the implementing decision are assumed to relate to CO₂ emissions only. This applies to Ireland, Latvia and Luxembourg. For Norway adjustments are separated by gas (EEA Joint Committee, 2012) and can be used without further adjustment.
2. Countries with estimate of historical emissions for N₂O but not for PFC: The N₂O emissions included in the implementing decision are deduced using the difference between the tables in Annex I and Annex II as they use distinct GWPs (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, Hungary⁽¹⁰⁾, Lithuania and Portugal).
3. Countries with estimate of historical emissions both for PFC and eventually N₂O: In this case both the contribution of N₂O and PFC in the amounts of the implementing decision has to be estimated based on inventory emissions (for more details see below). This applies to France, Germany, Greece, Iceland, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Slovenia⁽¹¹⁾, Spain, Sweden and United Kingdom.
4. Furthermore there are five countries without any cap adjustment for scope 3. These are Cyprus, Denmark, Estonia, Liechtenstein and Malta.

In a first step the CO₂ only cap adjustment in 2013 is estimated. For countries without estimate of historical emissions for non-CO₂ gases (group 1) the values can be used straight away. Calculations for the groups two and three are described below. In a further step CO₂ only cap adjustment in 2013 is extrapolated to 2005.

Countries with AEA adjustment for CO₂ and N₂O

For those countries with CO₂ and N₂O emissions only, the share of N₂O emissions included in the adjustment to annual emissions allocation can be deduced when comparing the two tables in the Annex of the implementing decision. The GWP for N₂O according to the second assessment report (SAR) is 310 whereas the GWP according to the fourth assessment report (AR4) is 298. The CO₂ emissions in the sums given can be expressed as follows:

⁽¹⁰⁾ Hungary did report PFC emissions in 2005 but in the following years PFC emissions were zero. It is therefore assumed that the emitting installation either closed or stopped producing primary aluminium and thus no allocation and no cap adjustment for PFC from aluminium was carried out for Hungary.

⁽¹¹⁾ In the case of Slovenia additional information on CO₂ emissions was provided.

$$CO_2 \text{ emissions } (t) = \text{total AEA adjustment } (t \text{ CO}_2e) - N_2O \text{ emissions } (t) * GWP \left(\frac{t \text{ CO}_2e}{t \text{ N}_2O} \right)$$

When this equation is filled twice; with the values in Annex I and Annex II of the implementing decision and the corresponding GWPs the two equations can be combined and simplified as follows:

$$N_2O \text{ emissions } (t) = \frac{AEA \text{ adjustment Annex I} - AEA \text{ adjustment Annex II}}{GWP \text{ SAR } (310) - GWP \text{ AR4 } (298)}$$

The resulting N₂O emissions (in t N₂O) can then be converted to CO₂ eq. and deducted from the total AEA adjustment. The resulting emissions can then be considered to represent the scope change due to inclusion of additional CO₂ emissions. The result for the countries Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, Hungary, Lithuania and Portugal can be found in Table 5-1.

Table 5-1 Calculation of CO₂ emissions in AEA adjustment for countries with estimate of historical emissions for N₂O and CO₂.

	Adjustment to annual emissions allocation (t CO ₂ eq.)		N ₂ O emissions in AEA adjustment (t N ₂ O)	N ₂ O emissions (t CO ₂ eq.)	CO ₂ emissions in AEA adjustment (t CO ₂)
	SAR	AR4		AR4	
	A	B	C = (A-B) / (310-298)	D = C * 298	E = B - D
Austria	2,026,990	2,018,185	734	218,658	1,799,528
Belgium	4,048,929	3,996,502	4,369	1,301,937	2,694,565
Bulgaria	1,750,024	1,728,601	1,785	532,005	1,196,597
Croatia	1,605,875	1,582,200	1,973	587,929	994,271
Czech Republic	3,000,270	2,978,152	1,843	549,264	2,428,888
Finland	1,769,997	1,720,524	4,123	1,228,580	491,945
Hungary	413,285	397,287	1,333	397,284	3
Lithuania	4,297,664	4,217,333	6,694	1,994,887	2,222,447
Portugal	563,543	563,543	0	0	563,543

Source: EC (2013), own calculations.

Note: All figures relate to the year 2013.

Countries with AEA adjustment for CO₂, PFC and N₂O

As above the estimate of historical emissions is based on the AEA adjustment published in the implementing decision (EC, 2013) and the decision of the EEA Joint Committee (2012). In order to avoid double counting as part of the estimated emissions for the non-CO₂ gases N₂O and PFC, we aim to estimate the CO₂ only share of the total AEA adjustments for 2013.

The approach used for countries with N₂O and CO₂ emissions only does not work in this case as there are too many unknowns in the equation – also for F-Gases the GWP have changed and furthermore covered PFC emissions from the production of primary aluminium consist of two gases.

Therefore we estimate the share of N₂O and PFC emissions as part of the total estimate of historical emissions at current ETS scope based on inventory data und subtract it from the total AEA adjustments to estimate the share of CO₂ in the total AEA adjustment.

Step 1: Understanding the methodology applied by the Commission for the AEA adjustments

To calculate the overall 2013 AEA adjustment, the Commission adjusted the data as submitted by the Member States⁽¹²⁾ with the 1.74% linear factor. To our understanding, the adjustment was carried out applying the linear reduction factor to “normalised 2010 emissions” and thus derive the AEA adjustment in 2013⁽¹³⁾.

$$\text{Adjustment to 2013 AEA} = (\text{Normalised 2010 emissions}) - 3 * 1.74\% * (\text{Normalised 2010 emissions}) = (\text{Normalised 2010 emissions}) * (1 - 3 * 1.74\%)$$

Normalised 2010 emissions were themselves estimated from average 2005–2009 emissions, following the same annual linear decrease between the midpoint of this period (2007) and the year 2010, this annual decrease being the one previously defined:

$$\text{Normalised 2010 emissions} = (\text{Average 2005–09 emissions}) - 3 * 1.74\% * (\text{Normalised 2010 emissions}) = (\text{Average 2005–09 emissions}) / (1 + 3 * 1.74\%)$$

And therefore:

$$\begin{aligned} \text{Adjustment to 2013 AEA} &= (\text{Average 2005–09 emissions}) * (1 - 3 * 1.74\%) / (1 + 3 * 1.74\%) \\ &= (\text{Average 2005–09 emissions}) * 90.08\% \end{aligned}$$

Step 2: Calculation of N₂O and PFC scope adjustment

The data submitted by Member States to the Commission is not publicly available. As a proxy we use inventory data for 2005–09. N₂O emissions are based on inventory data reported under CRF categories 2.B.2. Nitric acid production, 2.B.3. Adipic acid production, 2.B.4.b Glyoxal and 2.B.4.c Glyoxilic acid. PFC emissions are based on inventory data reported under CRF category 2.C.3. Aluminium production. The linear reduction factor is applied as explained in step 1 by multiplying the average 2005–09 emissions with 90.08%.

The inventory emissions may differ from the data submitted by Member States for several reasons.

1. Some Member States made use of the possibility to notify for non-CO₂ gases a lower amount of emissions according to the reduction potential of those installations (Art 9a(2) of the ETS directive).
2. The AEA adjustment refers to ETS allowances that will be issued. ETS allowances can only be issued to operational installations; if part of the N₂O or PFC emissions were emitted by installations that closed since; these amounts will not be allocated.
3. Not all Member States submitted information for all years.

⁽¹²⁾ “Data as submitted by the Member States pursuant to Article 9a(2) of Directive 2003/87/EC and as contained in Commission Decisions C(2011)3798, C(2008)7867, C(2009)3032, C(2009)9849 and C(2012)497 to accept the unilateral inclusion of additional greenhouse gases and activities by Italy, the Netherlands, Austria, Latvia and the United Kingdom pursuant to Article 24 of Directive 2003/87/EC, as well as taking in consideration the exclusion of installations with low emissions from the EU ETS by Germany, the United Kingdom, France, Spain, Croatia, Slovenia and Italy pursuant to Article 27 of Directive 2003/87/EC and adjusted by the Commission with the 1.74 % linear factor, were used in the calculation of the adjustment to each Member State’s annual emission allocation, as relevant.” (EU, 2013)

⁽¹³⁾ The linear reduction factor is applied by estimating an amount to be reduced each year, corresponding to 1.74% emissions in the base year / base period.

We assumed that the following Member States submitted only 20% of their actual 2005-09 N₂O emissions (after application of the annual linear reduction) to the Commission: Germany, Netherlands, Spain and Sweden. For UK we assume that no N₂O emissions were notified⁽¹⁴⁾.

For EFTA states the AEA adjustments were reported separately according to Article 9 (phase two scope), Article 9a(1) (opt-in installations) and Article 9a(2) (phase three scope) in the EU ETS directive. For Norway solely the adjustment according to Article 9a(2) was used. This does not include the N₂O emissions (which are reported under 9a(1)); therefore no deduction of N₂O emissions is necessary. In the case of Iceland no stationary installation participated prior to 2013; therefore the AEA adjustment used is the sum of figures pursuant to Article 9 and Article 9a(2).

The default applied to all other countries for N₂O and to all countries for PFC is 100% (after application of the linear reduction factor).

Step 3: Calculation of the resulting CO₂ scope adjustment

The calculated adjustments for N₂O and PFC are then deducted from the total AEA adjustment in 2013.

⁽¹⁴⁾ For the UK, the Annex I AEA adjustment (using SAR GWP) is slightly lower than the Annex II adjustment (using AR4 GWP). If N₂O emissions were taken into account, the Annex I figures would be higher as the SAR GWP is higher than the AR4 GWP.

Table 5-2 Calculation of N₂O and PFC components in 2013 AEA adjustment and resulting adjustments for CO₂.

	N ₂ O				PFC				All gases	CO ₂
	Average inventory emissions 2005-09	Application of LRF	Share notified to COM	Reduction of 2013 AEA adjustment	Average inventory emissions 2005-09	Application of LRF	Share notified to COM	Reduction of 2013 AEA adjustment	Total AEA adjustment 2013	AEA adjustment for CO ₂ (total - reductions)
		Mt CO ₂ eq.	%	Mt CO ₂ eq.		Mt CO ₂ eq.	%	Mt CO ₂ eq.	Mt CO ₂ eq.	Mt CO ₂ eq.
France	4.78	4.31	100%	4.31	0.68	0.61	100%	0.61	14.69	9.77
Germany	8.96	8.07	20%	1.61	0.28	0.25	100%	0.25	23.20	21.33
Greece	0.43	0.38	100%	0.38	0.05	0.04	100%	0.04	2.05	1.62
Iceland	0.00	0.00	100%	0.00	0.25	0.23	100%	0.23	1.76	1.53
Italy	2.79	2.51	100%	2.51	0.21	0.19	100%	0.19	9.61	6.91
Netherlands	3.19	2.88	20%	0.58	0.09	0.09	100%	0.09	2.14	1.48
Poland	3.44	3.10	100%	3.10	0.17	0.15	100%	0.15	10.94	7.69
Romania	1.96	1.76	100%	1.76	0.06	0.06	100%	0.06	7.45	5.63
Slovakia	1.29	1.16	100%	1.16	0.03	0.03	100%	0.03	1.85	0.67
Slovenia	0.00	0.00	100%	0.00	0.12	0.11	100%	0.11	-0.05	-0.16
Spain	1.25	1.13	20%	0.23	0.20	0.18	100%	0.18	7.99	7.59
Sweden	0.33	0.30	20%	0.06	0.39	0.35	100%	0.35	1.70	1.29
United Kingdom	2.26	2.04	0%	0.00	0.12	0.11	100%	0.11	0.24	0.13

Source: EC (2013); EEA Joint Committee (2012); GHG emissions inventory from EEA (2023a) and United Kingdom (2023), own calculations.

Estimate of historical CO₂ emissions to reflect the scope of the third trading period

With the adjustment of AEAs in 2013 based on CO₂ only, the estimate of historical emissions to reflect the scope of the third trading period for CO₂ emissions is calculated. The 2013 figures are used as a basis to calculate normalised 2010 emissions (by dividing the figures for 2013 by (1-3*1.74 %)). The annual cap adjustment equals 1.74 % of normalised 2010 emissions. This amount is added to previous years leading to a linear extrapolation up to 2005.

Table 5-3 Estimate of historical emissions at the scope of the third trading period (CO₂).

	Estimate for the scope of the 3rd trading period (CO ₂ only), in Mt CO ₂ e								
	1st trading period			2nd trading period					AEA adjust-ment for CO ₂
	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	2.06	2.03	2.00	1.96	1.93	1.90	1.87	1.83	1.80
Belgium	3.09	3.04	2.99	2.94	2.89	2.84	2.79	2.74	2.69
Bulgaria	1.37	1.35	1.33	1.31	1.28	1.26	1.24	1.22	1.20
Croatia	1.14	1.12	1.10	1.09	1.07	1.05	1.03	1.01	0.99
Cyprus									
Czech Republic	2.79	2.74	2.70	2.65	2.61	2.56	2.52	2.47	2.43
Denmark									
Estonia									
Finland	0.56	0.56	0.55	0.54	0.53	0.52	0.51	0.50	0.49
France	11.21	11.03	10.85	10.67	10.49	10.31	10.13	9.95	9.77
Germany	24.47	24.08	23.68	23.29	22.90	22.51	22.12	21.73	21.33
Greece	1.86	1.83	1.80	1.77	1.74	1.71	1.68	1.65	1.62
Hungary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iceland	1.75	1.73	1.70	1.67	1.64	1.61	1.59	1.56	1.53
Ireland	0.38	0.38	0.37	0.37	0.36	0.35	0.35	0.34	0.33
Italy	7.93	7.80	7.67	7.54	7.42	7.29	7.16	7.04	6.91
Latvia	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Liechtenstein									
Lithuania	2.55	2.51	2.47	2.43	2.39	2.34	2.30	2.26	2.22
Luxembourg	0.32	0.31	0.31	0.30	0.30	0.29	0.29	0.28	0.28
Malta									
Netherlands	1.70	1.67	1.64	1.61	1.59	1.56	1.53	1.51	1.48
Norway	4.78	4.70	4.63	4.55	4.47	4.40	4.32	4.24	4.17
Poland	8.81	8.67	8.53	8.39	8.25	8.11	7.97	7.83	7.69
Portugal	0.65	0.64	0.63	0.62	0.60	0.59	0.58	0.57	0.56
Romania	6.46	6.36	6.25	6.15	6.05	5.94	5.84	5.74	5.63
Slovakia	0.76	0.75	0.74	0.73	0.72	0.70	0.69	0.68	0.67
Slovenia	-0.18	-0.18	-0.17	-0.17	-0.17	-0.17	-0.16	-0.16	-0.16
Spain	8.70	8.56	8.42	8.28	8.14	8.00	7.86	7.73	7.59
Sweden	1.48	1.46	1.44	1.41	1.39	1.36	1.34	1.32	1.29
United Kingdom	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13
EU-27	88.13	86.72	85.31	83.90	82.49	81.07	79.66	78.25	76.84
All countries	94.81	93.30	91.78	90.26	88.74	87.22	85.71	84.19	82.67

Note: For Germany, Norway and Slovenia, these calculations are illustrative only; national data is used for the final scope estimate to be used in future EEA work (see Chapter 0).

Source: EC (2013); EEA Joint Committee (2012), own calculations.

5.2 CO₂ scope estimate reflecting changes between the third and the fourth trading period

Already prior to the fourth trading period it was possible to exclude small installations emitting less than 25 000 t CO₂e as long as they were subject to alternative and equivalent measures to reduce emissions (Art. 27 EU ETS directive). In 2020 six countries made use of this provision, the emissions excluded amounted to 1.7 Mt CO₂e in total (European Commission 2021).

Starting from 2021 further installations can be excluded to avoid undue administrative burden: installations that emit less than 2500 t CO₂e in each of the three years prior to exclusion and back-up units which do not operate more than 300 hours per year in a three-year timespan.

In 2021 both the number of countries making use of the rule as well as the emissions covered increased slightly (4.9 Mt CO₂e excluded in 14 countries, (European Commission 2022)). Still the amount is very small (0.37% of EU ETS emissions according to the same report). Furthermore only those installations additionally excluded compared to the third trading period can be attributed to the change in scope in the fourth trading period. We refrained from adding this element to the scope estimate as the uncertainty of the method would be in no relation to the importance of this scope estimate element.

5.3 Additional countries entering the EU ETS

5.3.1 *Iceland*

Iceland entered the EU ETS in 2013. The vast majority of Iceland's ETS emissions (99 %; EEA Joint Committee (2012)) are PFCs and CO₂ from the production of aluminium. This sector was included in the EU ETS (for all countries) in the third trading period. Therefore, the estimate of historical emissions for Iceland is covered by the overall estimate of historical emissions related to the change of ETS scope between the second and the third trading period, for which the method is described above.

5.3.2 *Croatia*

Croatia entered the EU ETS in 2013. Verified emissions from 2013 onwards are available in the EUTL. In the context of setting targets under the ESD, emissions of installations to be covered in the EU ETS, consistent with the scope of the second trading period, were made available for the years 2005, 2008, 2009 and 2010. To complete the time series between 2005 and 2012, missing values for 2006, 2007, 2011 and 2012 are calculated using the share of ETS emissions in inventory emissions of the next neighbouring year available (the 2005 share is used for 2006, 2008 share for 2007 and 2010 share for 2011 and 2012).

It is however important to note that because the data used to derive the estimate is based on data from before 2013; these pre-date the inclusion of Croatia as part of the EU ETS, unlike the figures for emissions from 2013 onwards. This means that the emissions data were not subject to the same framework of rules for monitoring, reporting and independent verification as was in place for those Member States which were part of the EU ETS in those years, and thus these estimated figures do not have a comparable basis in terms of overall data quality and robustness.

Table 5-4 Estimate of historical emissions to reflect the current ETS scope for Croatia (second trading period scope).

	1st trading period			2nd trading period				
	2005	2006	2007	2008	2009	2010	2011	2012
ETS scope 2 emissions from ESD target setting	10.65			10.87	9.48	8.71		
Sum of relevant inventory categories (CO2)	13.02	13.10	14.34	13.21	11.51	10.93	10.89	9.93
Share of ETS in inventory	82%			82%	82%	80%		
Resulting scope correction	10.65	10.71	11.80	10.87	9.48	8.71	8.68	7.92

Sources: Communication between Commission and Member States to determine annual emission allocation under the Effort Sharing Decision; GHG emissions inventory from EEA (2023a), own calculations.

6 Estimate of historical emissions based on national data

6.1 Germany

The German Emissions Trading Authority (Deutsche Emissionshandelsstelle - DEHSt) has estimated the emissions for activities not covered by the EU ETS in the first two trading periods based on bottom-up installation-specific data. Data stem from the applications for free allocation and the data collection for the inclusion of aviation and further activities (Datenerhebungsverordnung 2020) and has been checked and gap-filled by DEHSt. The scope extension between the first and the second trading period led to the inclusion of 27 additional installations as well as additional activities by four incumbent installations. With the third trading period a further 419 installations entered the scheme and 35 installations carrying out newly covered activities were identified. Gaps in the time series were filled with average values of other years of the relevant installation.

The information provided by Germany for non-CO₂ gases was based on AR4 GWPs and converted by us to AR5 GWPs.

Table 6-1 National bottom-up calculation of historical emissions to reflect third trading period scope for Germany (Mt CO₂-eq), non-CO₂ emissions based on AR5 GWPs.

	2005	2006	2007	2008	2009	2010	2011	2012
Total estimate to reflect 3rd TP scope	38.96	38.76	42.33	32.00	29.29	24.75	23.96	23.19
CO ₂	31.80	31.61	32.59	23.34	19.87	22.95	22.48	22.04
N ₂ O	6.95	6.99	9.58	8.48	9.31	1.68	1.36	1.04
PFC	0.21	0.16	0.16	0.18	0.11	0.12	0.12	0.11
ETS emissions EUTL (stationary)	475.05	478.07	487.15	472.85	428.29	454.86	450.35	452.59
Total emissions (including scope estimate)	514.01	516.84	529.478	504.86	457.58	479.61	474.31	475.78

Sources: German Environment Agency by Email; ETS verified emissions from EEA (2023b).

Note: Conversion of information provided in AR4 GWPs to AR5 GWPs by Öko-Institut.

6.2 Norway

The Norwegian Environment Agency has made an estimation of Norway's 2005-2012 emissions based on the scope of the third trading period. The methodology is a bottom-up approach using detailed actual emission data at installation level and adjustment according to methodology used in the Norwegian GHG inventory. Furthermore, changes compared to the NAP were taken into account. These are:

- For some installations the official emission figure for the period 2005-2012 has been retroactively corrected. This was reflected in the GHG inventory, but not in the NAP.
- Emissions from mobile rigs were included from 2011 without being included in the NAP.
- After co-incineration was included in phase three scope additional source streams were added for some installations. This is taken into account in the estimate below but was not part of the NAP.
- Emissions at a small scale from CCS installations are included.

National figures thus give a more accurate estimate of Norway's 2005-2012 emissions applying the third trading period scope. The estimate to reflect the third trading period scope for the years 2005-2012 is derived by subtracting emissions recorded on the EUTL from the numbers supplied by Norway (Table 6-2). The information provided by Norway for non-CO₂ gases was converted to CO₂eq. by us using AR5 GWPs.

Table 6-2 National bottom-up calculation of historical emissions to reflect third trading period scope for Norway (Mt CO₂-eq), non-CO₂ emissions based on AR4 GWPs.

	2005	2006	2007	2008	2009	2010	2011	2012
ETS emissions scope 3 (stationary)	26.48	25.96	27.27	26.54	24.24	25.42	25.00	24.55
CO ₂	23.95	23.80	25.23	24.94	23.45	24.90	24.52	24.13
N ₂ O	1.67	1.39	1.18	0.80	0.39	0.30	0.25	0.24
PFC	0.86	0.77	0.85	0.81	0.39	0.21	0.24	0.18
ETS emissions EUTL (stationary)	0.00	0.00	0.00	19.34	19.22	19.27	19.08	18.56
Estimate to reflect current scope	26.48	25.96	27.27	7.20	5.02	6.14	5.92	5.99

Sources: Norwegian Environment Agency by Email; ETS verified emissions from EEA (2023b).

Note: Conversion of information on non-CO₂-gases provided in t of gas to t CO₂eq. using AR5 GWPs by Öko-Institut.

6.3 Slovenia

The Jozef Stefan Institute - Energy Efficiency Centre in Slovenia has provided an estimation of Slovenian ETS emissions reflecting the scope of the third trading period based on bottom-up data (Table 6-3). Certain small installations were excluded from the ETS from 2013 onwards provided that they undertake equivalent measures to reduce GHG emissions. Those installations were marked and excluded when 2005-2012 current scope emissions were calculated based on the Slovenian ETS registry. PFC emissions related to the production of primary aluminium were added (based on inventory information). The information provided by Slovenia for non-CO₂ gases was based on AR4 GWPs and converted by us to AR5 GWPs.

Table 6-3 National bottom-up calculation of historical emissions to reflect third trading period scope for Slovenia (Mt CO₂-eq) , non-CO₂ emissions based on AR4 GWPs.

	2005	2006	2007	2008	2009	2010	2011	2012
ETS emissions scope 3 (stationary)	8.75	8.85	9.05	8.75	7.93	8.00	7.94	7.58
CO ₂	8.61	8.72	8.95	8.74	7.93	7.99	7.92	7.56
N ₂ O	0.00							
PFC	0.14	0.13	0.10	0.01	0.01	0.01	0.02	0.02
ETS emissions EUTL (stationary)	8.72	8.84	9.05	8.86	8.07	8.13	7.99	7.61
Estimate to reflect current scope	0.03	0.01	0.004	-0.11	-0.13	-0.13	-0.06	-0.03

Sources: Jozef Stefan Institute by Email; ETS verified emissions from EEA (2023b).

Note: Conversion of information provided in AR4 GWPs to AR5 GWPs by Öko-Institut.

7 References

DECC (2009): Report on 2008 EU Emissions Trading System emissions data (September), 2009.

EC - European Commission (2005): EC - European Commission. Communication from the Commission “Further guidance on allocation plans for the 2008 to 2012 trading period of the EU Emission Trading Scheme” (703 final). European Commission, 22 Dec 2005.

EC - European Commission (2014): Commission implementing regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council. In: OJ L (2014), pp. 23–90. Online available at <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0749&from=EN>, last accessed on 10 Nov 2018.

EC (2013): Commission Implementing Decision of 31 October 2013 on the adjustments to Member States’ annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/634/EU). In: OJ L (2013), pp. 19–22. Online available at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013D0634>, last accessed on 15 Aug 2014.

EEA - European Environment Agency (2023a): EEA greenhouse gas data viewer, European Environment Agency. European Environment Agency (ed.). Online available at <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>, last updated on 2023, last accessed on 26 Jun 2023.

EEA - European Environment Agency (2023b): EU Emissions Trading System (ETS) data viewer, EEA. European Environment Agency (ed.). Online available at <https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1>, last accessed on 6 Mar 2023.

EEA Joint Committee (2012): Decision of the EEA Joint Committee No 152/2012 of 26 July 2012 amending Annex XX (Environment) to the EEA Agreement. In: OJ L L (309), pp. 38–46. Online available at <http://www.efta.int/media/documents/legal-texts/eea/other-legal-documents/adopted-joint-committee-decisions/2012%20-%20English/152-2012.pdf>, last accessed on 4 Apr 2016.

ETC/ACC (2010): Cap adjustments in the EU-ETS according to Article 9a of the EU-ETS Directive (ETC/ACC Technical Paper, 2010/2), 2010.

European Commission (2020): Commission Implementing Regulation (EU) 2020/2085 of 14 December 2020 amending and correcting Implementing Regulation (EU) 2018/2066 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (Text with EEA relevance). Online available at <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32020R2085>, last accessed on 31 Mar 2022.

European Commission (ed.) (2021). Commission staff working document. Accompanying the document Report from the Commission to the European Parliament and the Council on the Functioning of the European Carbon Market in 2020 pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC (as amended by Directive 2009/29/EC and Directive (EU) 2018/410), SWD(2021) 308 final, 2021. Online available at https://climate.ec.europa.eu/system/files/2021-10/swd_2021_308_en.pdf, last accessed on 16 Jun 2023.

European Commission (ed.) (2022). Report from the Commission to the European Parliament and the Council on the Functioning of the European carbon market in 2021 pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC (as amended by Directive 2009/29/EC and Directive (EU) 2018/410), COM(2022) 516 final, 2022. Online available at <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0516>, last accessed on 26 Jun 2023.

Liechtenstein (2008): Nationaler Zuteilungsplan 2008-2012 für das Fürstentum Liechtenstein gemäss Artikel 9 der Richtlinie 2003/87/EG. Vaduz, 2008.

Norway (ed.) (2008). Norwegian National Allocation Plan for the Emissions Trading System in 2008–2012., 2008.

Real Decreto Ley 5/2005 (2005): Real Decreto Ley 5/2005, de 11 de marzo, de reformas urgentes para el impulso a la productividad y para la mejora de la contratación pública, 2005. Online available at http://noticias.juridicas.com/base_datos/Admin/rdl5-2005.t3.html#a33, last accessed on 15 May 2015.

United Kingdom (2023): Convention. Common Reporting Format (CRF) Table., GHG inventories. United Kingdom (ed.). Online available at <https://unfccc.int/documents/627795>, last accessed on 26 Jun 2023.

Abbreviations, units and symbols

Abbreviation	Name
AR4	Fourth Assessment Report by IPCC
AR5	Fifth Assessment Report by IPCC
CO ₂	Carbon Dioxide
CO ₂ eq.	Carbon Dioxide equivalent
CRF	Common Reporting Format (for GHG inventories)
EFTA	European Free Trade Association
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
EU ETS	EU Emissions Trading Scheme
EUTL	European Union Transaction Log
GHG	Greenhouse gas
GWP	Global warming potential
IPCC	Intergovernmental Panel on Climate Change
N ₂ O	Nitrous oxide
PFC	Perfluorocarbons
SAR	Second Assessment Report by IPCC

Annex 1: Detailed figures of estimates of historical emissions to reflect current ETS scope by country

Table A1-1 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Austria (Mt CO₂-eq).

Austria	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	33.37	32.38	31.75	32.08	27.36	30.92	30.60	28.39	29.77	28.02	29.46	28.97	30.53	28.38	29.54	27.01
Total estimate to reflect current ETS scope	2.65	2.62	2.58	2.24	2.07	1.89	1.86	1.83	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01
New countries																
CO2 scope 2	0.35	0.35	0.35													
N2O	0.23	0.24	0.23	0.28	0.14	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01
PFC																
CO2 scope 3	2.06	2.03	2.00	1.96	1.93	1.90	1.87	1.83								

Table A1-2 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Belgium (Mt CO₂-eq).

Belgium	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	55.36	54.78	52.80	55.46	46.21	50.10	46.20	43.01	45.23	43.85	44.71	43.66	43.77	44.18	44.63	41.51
Total estimate to reflect current ETS scope	10.90	9.99	9.34	4.14	4.14	4.40	3.29	3.28	-0.05	-0.05	-0.03	-0.03	-0.04	-0.02	-0.02	-0.03
New countries																
CO2 scope 2	5.19	5.19	5.19													
N2O	2.62	1.76	1.16	1.20	1.25	1.55	0.50	0.54	-0.05	-0.05	-0.03	-0.03	-0.04	-0.02	-0.02	-0.03
PFC																
CO2 scope 3	3.09	3.04	2.99	2.94	2.89	2.84	2.79	2.74								

Table A1-3 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Bulgaria (Mt CO₂-eq).

Bulgaria	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL			39.18	38.30	32.01	33.53	40.00	35.05	32.70	34.31	36.26	33.41	34.91	31.03	29.19	23.85
Total estimate to reflect current ETS scope	37.87	37.93	1.85	1.80	1.52	1.49	1.44	1.33	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries	35.71	36.16														
CO2 scope 2																
N2O	0.78	0.42	0.52	0.50	0.23	0.23	0.20	0.11	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
PFC																
CO2 scope 3	1.37	1.35	1.33	1.31	1.28	1.26	1.24	1.22								

Table A1-4 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Croatia (Mt CO₂-eq).

Croatia	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL									8.79	8.39	8.39	8.27	8.37	7.44	7.51	7.32
Total estimate to reflect current ETS scope	12.36	12.39	13.52	12.58	11.07	10.44	10.39	9.51	-0.02	-0.03	-0.03	-0.01	-0.01	0.00	0.00	-0.01
New countries	10.65	10.71	11.80	10.87	9.48	8.71	8.68	7.92								
CO2 scope 2																
N2O	0.57	0.56	0.62	0.63	0.53	0.68	0.67	0.58	-0.02	-0.03	-0.03	-0.01	-0.01	0.00	0.00	-0.01
PFC																
CO2 scope 3	1.14	1.12	1.10	1.09	1.07	1.05	1.03	1.01								

Table A1-5 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Cyprus (Mt CO₂-eq).

Cyprus	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	5.08	5.26	5.40	5.58	5.36	5.06	4.60	4.38	4.02	4.47	4.37	4.65	4.67	4.59	4.47	4.29
Total estimate to reflect current ETS scope																
New countries																
CO2 scope 2																
N2O																
PFC																
CO2 scope 3																

Table A1-6 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Czechia (Mt CO₂-eq).

Czech Republic	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL																
Total estimate to reflect current ETS scope	3.58	3.44	3.27	3.19	3.01	2.85	2.85	2.81	-0.02	-0.03	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2																
N2O	0.79	0.70	0.58	0.54	0.40	0.29	0.33	0.34	-0.02	-0.03	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01
PFC																
CO2 scope 3	2.79	2.74	2.70	2.65	2.61	2.56	2.52	2.47								

Table A1-7 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Denmark (Mt CO₂-eq).

Denmark	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	26.48	34.20	29.41	26.55	25.46	25.27	21.47	18.19	21.60	18.39	15.80	17.22	15.06	14.95	12.04	10.83
Total estimate to reflect current ETS scope																
New countries																
CO2 scope 2																
N2O																
PFC																
CO2 scope 3																

Table A1-8 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Estonia (Mt CO₂-eq)

Estonia	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	12.62	12.10	15.33	13.54	10.38	14.51	14.81	13.54	15.92	14.97	11.89	13.45	14.67	13.85	8.49	5.62
Total estimate to reflect current ETS scope	0.25	0.25	0.25													
New countries																
CO2 scope 2	0.25	0.25	0.25													
N2O																
PFC																
CO2 scope 3																

Table A1-9 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Finland (Mt CO₂-eq)

Finland	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	33.10	44.62	42.54	36.16	34.35	41.30	35.09	29.50	31.34	28.63	25.35	27.12	25.04	26.17	23.24	19.58
Total estimate to reflect current ETS scope	2.35	2.18	2.21	1.89	1.21	0.66	0.63	0.64	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
New countries																
CO2 scope 2	0.40	0.40	0.40													
N2O	1.39	1.23	1.26	1.35	0.68	0.14	0.12	0.14	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
PFC																
CO2 scope 3	0.56	0.56	0.55	0.54	0.53	0.52	0.51	0.50								

Table A1-10 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in France (Mt CO₂-eq)

France	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	131.26	126.98	126.63	124.13	111.09	115.54	105.58	103.66	114.59	100.27	99.69	101.72	106.84	97.49	94.30	82.14
Total estimate to reflect current ETS scope	21.91	21.07	20.44	14.53	13.63	11.91	11.18	10.78	-0.08	-0.09	-0.09	-0.08	-0.15	-0.09	-0.08	-0.06
New countries																
CO2 scope 2	4.71	4.71	4.71													
N2O	5.24	4.71	4.43	3.77	3.12	1.55	0.96	0.71	-0.07	-0.08	-0.08	-0.07	-0.14	-0.09	-0.07	-0.05
PFC	0.75	0.63	0.46	0.09	0.03	0.05	0.09	0.12	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.01
CO2 scope 3	11.21	11.03	10.85	10.67	10.49	10.31	10.13	9.95								

Table A1-11 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Germany (Mt CO₂-eq)

Germany	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	475.05	478.07	487.15	472.85	428.29	454.86	450.35	452.59	481.04	461.25	455.61	452.81	437.61	422.85	363.32	320.71
Total estimate to reflect current ETS scope	42.94	42.24	44.12	31.63	31.52	23.88	23.10	22.48	-0.09	-0.08	-0.08	-0.08	-0.08	-0.07	-0.06	-0.06
New countries																
CO2 scope 2	11.00	11.00	11.00													
N2O	7.13	6.96	9.24	8.08	8.43	1.23	0.90	0.68	-0.08	-0.07	-0.08	-0.07	-0.07	-0.06	-0.06	-0.06
PFC	0.35	0.20	0.20	0.26	0.19	0.14	0.09	0.08	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
CO2 scope 3	24.47	24.08	23.68	23.29	22.90	22.51	22.12	21.73								

Table A1-12 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Greece (Mt CO₂-eq)

Greece	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	71.27	69.97	72.72	69.85	63.66	59.94	58.84	61.44	58.63	55.37	49.88	46.30	49.57	47.11	40.48	31.73
Total estimate to reflect current ETS scope	2.37	2.25	2.22	2.18	2.08	2.11	2.13	1.97	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2																
N2O	0.47	0.38	0.38	0.36	0.31	0.37	0.41	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC	0.05	0.04	0.04	0.05	0.02	0.04	0.04	0.05	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
CO2 scope 3	1.86	1.83	1.80	1.77	1.74	1.71	1.68	1.65								

Table A1-13 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Hungary (Mt CO₂-eq)

Hungary	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	26.16	25.85	26.84	27.24	22.40	22.99	22.47	21.27	19.13	18.82	19.65	19.40	20.64	20.05	19.53	18.91
Total estimate to reflect current ETS scope	3.16	2.65	2.21	0.00	0.01	0.01	0.01	0.02	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
New countries																
CO2 scope 2																
N2O	1.43	1.43	1.43													
N2O	1.48	1.22	0.77	0.00	0.01	0.01	0.01	0.02	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
PFC	0.25															
CO2 scope 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								

Table A1-14 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Iceland (Mt CO₂-eq)

Iceland	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL									1.78	1.75	1.81	1.78	1.83	1.85	1.81	1.78
Total estimate to reflect current ETS scope	1.78	2.08	2.00	2.04	1.80	1.77	1.65	1.64	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2																
N2O																
PFC	0.03	0.35	0.30	0.37	0.16	0.15	0.07	0.08	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
CO2 scope 3	1.75	1.73	1.70	1.67	1.64	1.61	1.59	1.56								

Table A1-15 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Ireland (Mt CO₂-eq)

Ireland	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	22.44	21.71	21.25	20.38	17.22	17.37	15.77	16.90	15.69	15.96	16.83	17.74	16.90	15.53	14.16	13.30
Total estimate to reflect current ETS scope	0.34	0.34	0.33	0.37	0.36	0.35	0.35	0.34								
New countries																
CO2 scope 2	-0.04	-0.04	-0.04													
N2O																
PFC																
CO2 scope 3	0.38	0.38	0.37	0.37	0.36	0.35	0.35	0.34								

Table A1-16 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Italy (Mt CO₂-eq)

Italy	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	225.99	227.44	226.41	220.68	184.88	191.49	189.96	179.07	164.50	152.58	156.21	154.96	155.33	146.48	140.94	126.03
Total estimate to reflect current ETS scope	20.67	16.14	15.42	8.57	8.54	7.93	7.28	7.04	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2	5.92	5.92	5.92													
N2O	6.63	2.26	1.62	0.91	0.97	0.55	0.04	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
PFC	0.19	0.16	0.21	0.12	0.15	0.09	0.09	0.03								
CO2 scope 3	7.93	7.80	7.67	7.54	7.42	7.29	7.16	7.04								

Table A1-17 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Latvia (Mt CO₂-eq)

Latvia	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	2.85	2.94	2.85	2.74	2.49	3.24	2.92	2.74	2.65	2.35	2.31	2.20	2.05	2.61	2.49	2.02
Total estimate to reflect current ETS scope	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02								
New countries																
CO2 scope 2																
N2O																
PFC																
CO2 scope 3	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02								

Table A1-18 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Liechtenstein (Mt CO₂-eq)

Liechtenstein	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL				0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total estimate to reflect current ETS scope	0.02	0.02	0.02													
New countries	0.02	0.02	0.02													
CO2 scope 2																
N2O																
PFC																
CO2 scope 3																

Table A1-19 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Lithuania (Mt CO₂-eq)

Lithuania	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	6.60	6.52	6.00	6.10	5.79	6.39	5.61	5.72	7.46	6.86	6.84	6.16	6.28	5.95	6.07	6.14
Total estimate to reflect current ETS scope	4.67	4.64	5.18	4.91	2.95	2.84	3.06	2.77	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
New countries																
CO2 scope 2	0.06	0.06	0.06													
N2O	2.06	2.07	2.66	2.48	0.56	0.49	0.76	0.51	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
PFC																
CO2 scope 3	2.55	2.51	2.47	2.43	2.39	2.34	2.30	2.26								

Table A1-20 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Luxembourg (Mt CO₂-eq)

Luxembourg	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	2.60	2.71	2.57	2.10	2.18	2.25	2.05	1.99	1.85	1.93	1.66	1.50	1.49	1.47	1.50	1.38
Total estimate to reflect current ETS scope	0.32	0.31	0.31	0.30	0.30	0.29	0.29	0.28								
New countries																
CO2 scope 2																
N2O																
PFC																
CO2 scope 3	0.32	0.31	0.31	0.30	0.30	0.29	0.29	0.28								

Table A1-21 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Malta (Mt CO2-eq)

Malta	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	1.97	1.99	2.03	2.02	1.90	1.88	1.93	2.05	1.70	1.66	0.89	0.58	0.72	0.70	0.74	0.81
Total estimate to reflect current ETS scope																
New countries																
CO2 scope 2																
N2O																
PFC																
CO2 scope 3																

Table A1-22 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in the Netherlands (Mt CO2-eq)

Netherlands	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	80.35	76.70	79.87	83.51	81.03	84.74	79.97	76.43	86.95	89.07	94.11	93.88	91.44	87.41	83.75	74.11
Total estimate to reflect current ETS scope	10.55	10.44	9.35	1.62	1.57	1.58	1.59	1.49	-0.03	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.02
New countries																
CO2 scope 2	3.92	3.92	3.92													
N2O	4.84	4.78	3.68	-0.07	-0.06	-0.04	-0.03	-0.03	-0.03	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.02
PFC	0.09	0.06	0.10	0.08	0.05	0.06	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 scope 3	1.70	1.67	1.64	1.61	1.59	1.56	1.53	1.51								

Table A1-23 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Norway (Mt CO2-eq)

Norway	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL				19.34	19.22	19.27	19.08	18.56	24.70	24.98	25.70	25.21	25.41	25.20	24.62	23.70
Total estimate to reflect current ETS scope	25.13	25.06	25.23	5.70	4.81	4.57	4.52	4.39	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02
New countries	17.82	18.19	18.57													
CO2 scope 2																
N2O	1.67	1.39	1.18	0.34	-0.06	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01
PFC	0.86	0.77	0.85	0.81	0.39	0.21	0.24	0.18	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01
CO2 scope 3	4.78	4.70	4.63	4.55	4.47	4.40	4.32	4.24								

Table A1-24 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Poland (Mt CO2-eq)

Poland	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	203.15	209.62	209.62	204.11	191.17	199.73	203.03	196.64	205.74	197.13	198.70	198.05	202.17	199.97	183.69	171.73
Total estimate to reflect current ETS scope	17.65	17.49	17.50	11.77	8.99	8.89	8.66	8.62	-0.06	-0.05	-0.05	-0.06	-0.05	-0.05	-0.04	-0.04
New countries																
CO2 scope 2	4.95	4.95	4.95													
N2O	3.74	3.71	3.87	3.25	0.74	0.78	0.69	0.79	-0.06	-0.05	-0.05	-0.06	-0.05	-0.05	-0.04	-0.04
PFC	0.15	0.16	0.15	0.13												
CO2 scope 3	8.81	8.67	8.53	8.39	8.25	8.11	7.97	7.83								

Table A1-25 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Portugal (Mt CO2-eq)

Portugal	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	36.43	33.06	31.20	29.91	28.26	24.17	25.01	25.25	24.66	24.20	27.96	25.76	30.08	26.29	21.60	18.73
Total estimate to reflect current ETS scope	1.91	1.89	1.90	1.08	0.93	0.95	0.66	0.63	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
New countries																
CO2 scope 2	0.77	0.77	0.77													
N2O	0.50	0.49	0.51	0.46	0.33	0.35	0.08	0.06	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
PFC																
CO2 scope 3	0.65	0.64	0.63	0.62	0.60	0.59	0.58	0.57								

Table A1-26 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Romania (Mt CO2-eq)

Romania	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL			69.61	63.82	49.06	47.34	51.24	47.86	42.41	42.58	42.40	39.78	40.62	39.64	36.55	32.67
Total estimate to reflect current ETS scope	70.43	70.22	8.65	7.13	6.66	7.01	6.90	6.63	-0.05	-0.04	-0.03	-0.03	-0.03	-0.02	-0.01	-0.01
New countries	61.23	61.70														
CO2 scope 2																
N2O	2.65	2.11	2.37	0.96	0.60	1.05	1.05	0.89	-0.05	-0.04	-0.03	-0.03	-0.02	-0.02	-0.01	-0.01
PFC	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 scope 3	6.46	6.36	6.25	6.15	6.05	5.94	5.84	5.74								

Table A1-27 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Slovakia (Mt CO2-eq)

Slovakia	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	25.23	25.54	24.52	25.34	21.60	21.70	22.22	20.94	21.83	20.92	21.18	21.26	22.06	22.19	19.90	18.17
Total estimate to reflect current ETS scope	3.68	3.94	3.77	1.89	1.67	1.50	1.07	0.96	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2	1.79	1.79	1.79													
N2O	1.10	1.35	1.21	1.12	0.93	0.77	0.36	0.26	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
PFC	0.02	0.04	0.03	0.04	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 scope 3	0.76	0.75	0.74	0.73	0.72	0.70	0.69	0.68								

Table A1-28 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Slovenia (Mt CO2-eq)

Slovenia	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	8.72	8.84	9.05	8.86	8.07	8.13	7.99	7.61	7.39	6.12	6.11	6.48	6.57	6.49	6.25	6.10
Total estimate to reflect current ETS scope	-0.05	-0.06	-0.09	-0.16	-0.16	-0.16	-0.15	-0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New countries																
CO2 scope 2																
N2O	0.00															
PFC	0.13	0.12	0.09	0.01	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 scope 3	-0.18	-0.18	-0.17	-0.17	-0.17	-0.17	-0.16	-0.16								

Table A1-29 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Spain (Mt CO2-eq)

Spain	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	183.63	179.72	186.57	163.46	136.94	121.48	132.69	135.64	122.81	124.85	137.27	123.56	136.32	127.37	109.52	89.04
Total estimate to reflect current ETS scope	16.69	10.07	9.62	9.29	9.02	8.53	8.17	7.91	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.02
New countries																
CO2 scope 2	6.22															
N2O	1.58	1.33	1.03	0.84	0.77	0.43	0.22	0.14	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
PFC	0.19	0.18	0.17	0.16	0.11	0.09	0.08	0.05	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00
CO2 scope 3	8.70	8.56	8.42	8.28	8.14	8.00	7.86	7.73								

Table A1-30 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in Sweden (Mt CO2-eq)

Sweden	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	19.38	20.00	19.04	20.08	17.49	22.66	19.85	18.17	20.14	19.33	19.24	19.88	19.76	20.00	18.90	16.71
Total estimate to reflect current ETS scope	3.89	3.86	3.66	1.94	1.68	1.80	1.57	1.44	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
New countries																
CO2 scope 2	1.67	1.67	1.67													
N2O	0.38	0.39	0.21	0.23	0.26	0.27	0.04	0.06	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00
PFC	0.36	0.34	0.35	0.30	0.04	0.17	0.19	0.07	0.00	-0.01	0.00	0.00	0.00	-0.01	0.00	-0.01
CO2 scope 3	1.48	1.46	1.44	1.41	1.39	1.36	1.34	1.32								

Table A1-31 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in the United Kingdom (Mt CO2-eq)

United Kingdom	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	237.16	245.41	251.88	260.22	228.24	233.36	217.12	227.26	221.15	194.14	172.18	143.33	133.63	126.00	115.86	102.58
Total estimate to reflect current ETS scope	31.92	31.45	23.14	2.41	1.23	1.38	0.33	0.14	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01
New countries																
CO2 scope 2	29.15	29.15	20.55													
N2O	2.52	2.02	2.35	2.14	1.02	1.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PFC	0.10	0.13	0.09	0.12	0.06	0.12	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 scope 3	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13								

Table A1-32 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in the EU-27 (Mt CO2-eq)

EU-27	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	1689.11	1701.00	1820.31	1754.86	1554.66	1606.60	1590.24	1548.02	1588.56	1522.27	1532.77	1508.75	1523.48	1460.21	1322.81	1170.43
Total estimate to reflect current ETS scope	291.10	307.78	200.76	125.33	114.01	102.56	96.68	92.79	-0.57	-0.55	-0.53	-0.47	-0.52	-0.44	-0.38	-0.34
New countries																
CO2 scope 2	48.60	42.37	42.37													
N2O	44.17	36.68	36.33	26.90	20.21	10.72	7.29	6.01	-0.53	-0.51	-0.50	-0.43	-0.48	-0.40	-0.35	-0.31
PFC	2.61	1.98	1.81	1.25	0.61	0.67	0.71	0.47	-0.04	-0.04	-0.03	-0.04	-0.04	-0.05	-0.03	-0.03
CO2 scope 3	88.13	86.72	85.31	83.90	82.49	81.07	79.66	78.25								

Table A1-33 Verified ETS emissions and estimates reflecting third trading period scope for stationary installations in all ETS countries incl. UK (Mt CO₂-eq)

All countries	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Verified emissions EUTL	1926.27	1946.42	2072.20	2034.44	1802.13	1859.23	1826.45	1793.84	1836.18	1743.14	1732.47	1679.07	1684.35	1613.26	1465.10	1298.49
Total estimate to reflect current ETS scope	349.95	334.94	228.00	133.07	120.62	108.90	102.85	98.82	-0.62	-0.60	-0.58	-0.52	-0.56	-0.49	-0.43	-0.38
New countries	125.43	126.78	30.39	10.87	9.48	8.71	8.68	7.92								
CO ₂ scope 2	77.75	71.52	62.92													
N ₂ O	48.36	40.10	39.86	29.39	21.17	11.80	7.28	5.97	-0.56	-0.54	-0.53	-0.46	-0.51	-0.42	-0.37	-0.32
PFC	3.60	3.24	3.05	2.55	1.23	1.16	1.18	0.74	-0.06	-0.06	-0.06	-0.06	-0.05	-0.07	-0.06	-0.06
CO ₂ scope 3	94.81	93.30	91.78	90.26	88.74	87.22	85.71	84.19								

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