Department for Energy Security & Net Zero

Annual Statement of Emissions for 2023

Reporting UK 2023 emissions to Parliament under the Climate Change Act 2008

March 2025

Department for Energy Security and Net Zero

Annual Statement of Emissions for 2023

Presented to Parliament pursuant to section 16 of the Climate Change Act 2008

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Contents

Introduction

The Climate Change Act 2008[1] requires that the Government reports greenhouse gas (GHG) emissions to Parliament annually. This is the sixteenth Annual Statement of Emissions required under section 16 of the Climate Change Act 2008. It confirms emissions for 2023 – the first year of the fourth carbon budget. The statement required by section 16 of the Act must be laid before Parliament not later than 31st March in the second year following that to which it relates.

The fourth carbon budget covers the period 2023-2027, with an emissions cap of 1,950.0 million tonnes of carbon dioxide equivalent (tCO2e)[2]. This means the net UK carbon account must be on average lower than 390.0 million tCO2e each year for the UK to meet the fourth carbon budget.

GHG emissions reported in Annual Statements of Emissions are based on the latest final UK GHG emissions Accredited Official Statistics[3]. The Accredited Official Statistics used to compile this statement show that net UK emissions for the first year of the fourth carbon budget period (2023) were 385.0 million tCO2e, a 53% reduction in net GHG emissions from the base year[4].

The 2023 net UK carbon account was 385.0 million tCO2e. No adjustments for carbon unit trading were made to the net UK carbon account in 2023. The UK ended its participation in the European Union Emissions Trading System ("EU ETS") in 2020, and no other adjustments for carbon unit trading have been required. The 2023 net UK carbon account was equal to UK territorial emissions as reported in the Accredited Official Statistics.

Emissions estimates are revised annually to incorporate new data, improved methods and changes to international guidelines. Therefore, the 2023 net UK carbon account will be revised in future Annual Statement of Emissions and not be finalised until 2029 when performance against the fourth carbon budget is assessed[5]. Revisions to years within the same carbon budget period are made in line with section 16(4) of the Climate Change Act 2008.

Structure of the report

Part one of this statement shows the total amount of UK GHGs emitted to and removed from the atmosphere in the base year, 2022, and 2023; the methods used to calculate those official

[1] http://www.legislation.gov.uk/ukpga/2008/27/contents.
[2] This is the level of the fourth carbon budget, as legislated in 2011: https://www.legislation.gov.uk/uksi/2011/1603/made
[3] The final 2023 estimates of UK GHG emissions were published on 6 February 2025: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-statistics-1990-to-2023
[4] The base year varies by GHG (1990 for CO2, CH4 and N2O; 1995 for Fluorinated gases): http://www.legislation.gov.uk/ukpga/2008/27/part/1/crossheading/targeted-greenhouse-gases
[5] UK GHG emissions for 1990-2027 will be published in 2029.

estimates; and whether there was an increase or a decrease in emissions and removals between 2022 and 2023.

Part two of this statement sets out the steps taken to calculate the “net UK carbon account” for 2023.

Explaining the net UK carbon account

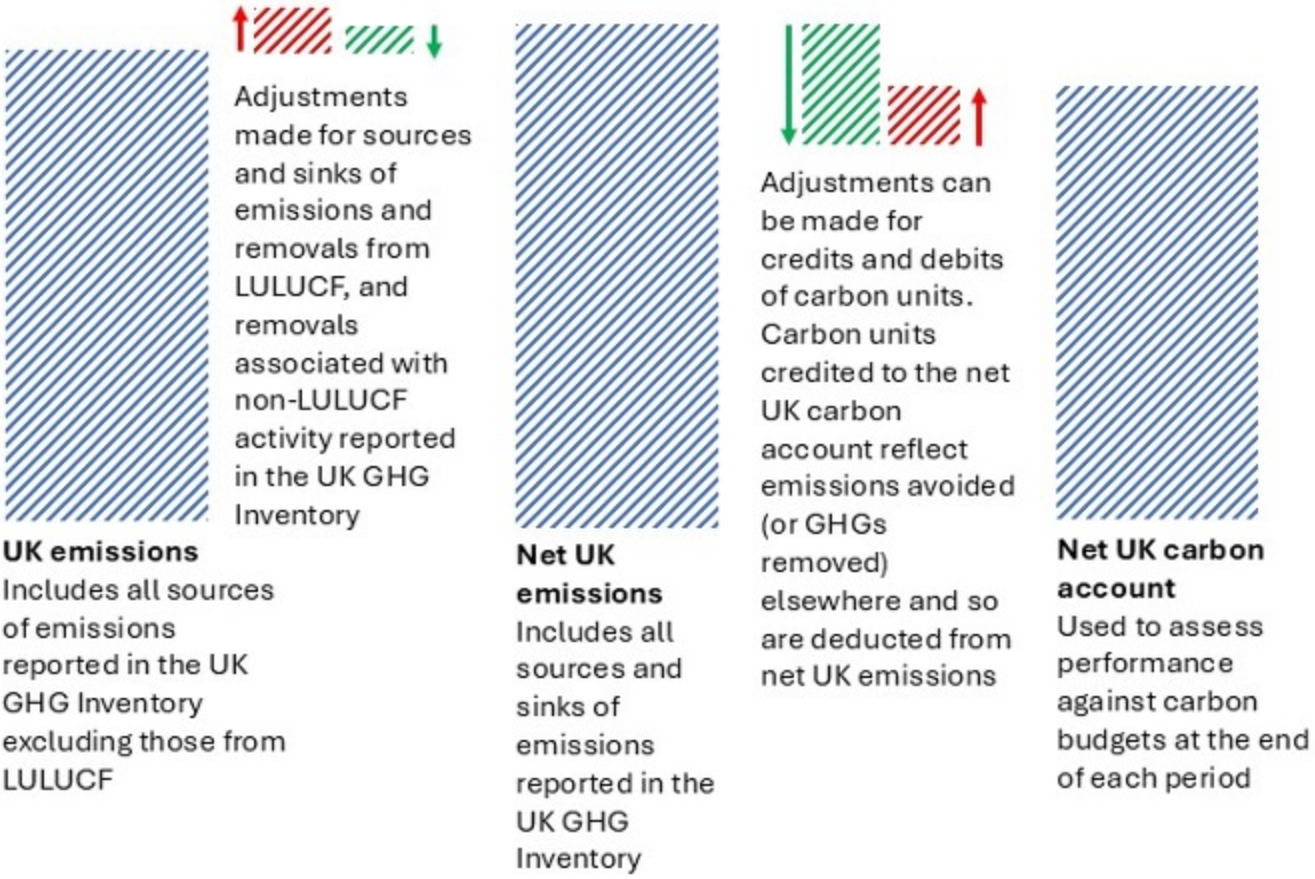
Section 27 of the Climate Change Act defines the “net UK carbon account”. This is what we compare against carbon budgets to determine whether we are meeting them. The net UK carbon account for the relevant budgetary period must not exceed the level of the carbon budget at the end of each budgetary period. The process for determining the net UK carbon account is summarised in Figure 1.

The starting point is UK emissions for the year, comprising emissions from all sources in the UK, excluding those from land use, land use change and forestry (LULUCF). These are then adjusted to take account of emissions and removals by sources and sinks associated with LULUCF activity, and removals associated with non-LULUCF activity which are currently not reported. The new total is referred to as net UK emissions. Data are sourced from the annual Accredited Official Statistics on territorial UK GHG emissions[6].

Section 27 of the Climate Change Act 2008 makes provision for regulations to be made in relation to the crediting to or debiting from the net UK carbon account of specified carbon units. Up until 2020, when the UK was participating in the EU ETS, the net UK carbon account was adjusted to reflect net trading of emissions allowances. From 2021, the UK was no longer participating in the EU ETS, and no other adjustments were required for carbon unit trading. As such, the 2023 net UK carbon account reported in this Annual Statement of Emissions is equal to 2023 UK net territorial GHG emissions, pursuant to sections 29(2) and 89 of the Act.

[6] The final 2023 estimates of UK GHG emissions were published on 6 February 2025: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-statistics-1990-to-2023

Figure 1. Calculating the net UK carbon account (illustrative only)



Note – LULUCF includes both emissions and removals and so can be a net source or sink of GHGs, depending on a variety of factors, including the age profile of UK forests. A negative value means the net effect is the removal of GHGs from the atmosphere, whereas a positive value means the net effect is the addition of GHGs to the atmosphere.

Part 1 – UK GHG emissions

The information contained in this part of the statement is derived from the UK 1990-2023 GHG emissions statistics[7], which were published on 6th February 2025. Emissions coverage under the Climate Change Act 2008 comprises UK territory only (i.e. England, Wales, Scotland and Northern Ireland)[8]. Unless otherwise stated, all official estimates in this section are stated in tonnes of carbon dioxide equivalent (tCO2e)[9].

Base year, 2022, and 2023 GHG emissions by gas

Section 16(2)(a), 16(2)(c), 16(3) and 16(8) of the Climate Change Act

Table 1 below sets out the base year[10] emissions – the emissions in the year against which progress is measured – for each GHG covered by the Climate Change Act. The table also sets out the total UK emissions for 2023, and whether any of those amounts represent an increase or decrease compared to the equivalent amount for the previous year. Emissions are grouped into:

a) emissions (excluding LULUCF)

b) net LULUCF emissions/removals

c) net emissions/removals (including net LULUCF)

[7] The final 2023 estimates of UK GHG emissions were published on 6 February 2025: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-statistics-1990-to-2023

[8] Section 89 of the Climate Change Act specifies that this includes UK coastal waters and the UK sector of the continental shelf. http://www.legislation.gov.uk/ukpga/2008/27/section/89

[9] This is the usual way of reporting GHGs to account for the different global warming potentials of each gas. The global warming potential (GWPs) of a gas is a measure of its impact on global warming relative to carbon dioxide. The GWPs used for each gas in the UK inventory in this publication are based on those published in the Intergovernmental Panel on Climate Change's (IPCC's) 5th Assessment report: https://www.ipcc.ch/assessment-report/ar5/

[10] The base year varies by GHG (1990 for CO2, CH4 and N2O; 1995 for Fluorinated gases) http://www.legislation.gov.uk/ukpga/2008/27/part/1/crossheading/targeted-greenhouse-gases

Table 1: UK GHG emissions/removals by gas (tCO2e)

Emissions	GHG	Base year	2022	2023	2022 to 2023 change
Emissions (excluding net LULUCF emissions/removals)	Carbon dioxide (CO2)	600,202,028	327,258,541	308,765,251	-18,493,290
	Methane (CH4)	142,944,855	52,365,844	51,264,167	-1,101,677
	Nitrous oxide (N2O)	42,153,125	16,961,964	16,778,758	-183,206
	Hydrofluorocarbons (HFC)	15,486,111	7,068,989	6,597,489	-471,500
	Perfluorocarbons (PFC)	533,270	151,673	145,323	-6,350
	Sulphur hexafluoride (SF6)	1,290,991	333,443	301,792	-31,651
	Nitrogen trifluoride (NF3)	256	63	63	0
	Total	802,610,638	404,140,516	383,852,842	-20,287,674
Net LULUCF emissions/removals	Carbon dioxide (CO2)	3,136,689	-6,483,329	-5,946,505	536,823
	Methane (CH4)	5,569,854	5,719,393	5,751,291	31,898
	Nitrous oxide (N2O)	1,917,330	1,305,688	1,314,928	9,240
	Hydrofluorocarbons (HFC)	0	0	0	0
	Perfluorocarbons (PFC)	0	0	0	0
	Sulphur hexafluoride (SF6)	0	0	0	0
	Nitrogen trifluoride (NF3)	0	0	0	0
	Total	10,623,873	541,752	1,119,714	577,962
Net emissions (including net LULUCF emissions/removals)	Carbon dioxide (CO2)	603,338,717	320,775,212	302,818,746	-17,956,466

Methane (CH4)	148,514,709	58,085,237	57,015,458	-1,069,779
Nitrous oxide (N2O)	44,070,455	18,267,651	18,093,685	-173,966
Hydrofluorocarbons (HFC)	15,486,111	7,068,989	6,597,489	-471,500
Perfluorocarbons (PFC)	533,270	151,673	145,323	-6,350
Sulphur hexafluoride (SF6)	1,290,991	333,443	301,792	-31,651
Nitrogen trifluoride (NF3)	256	63	63	0
Total	813,234,510	404,682,268	384,972,556	-19,709,712

Note - A negative value in the base year, 2022 and 2023 means the net effect is the removal of GHGs from the atmosphere, whereas a positive value means the net effect is the addition of GHGs to the atmosphere.

Method used to calculate GHG emissions and removals

Section 16(2)(b) and 16(4) of the Climate Change Act

The UK GHG Inventory is compiled in line with international guidance from the Intergovernmental Panel on Climate Change[11] (IPCC). Each year the inventory is updated to include the latest data available. Methodological changes are made to take account of new data sources, or new guidance from the IPCC, and new research, sponsored by DESNZ or otherwise. Improvements to the methodology are backdated as required under the Climate Change Act. The UK National Inventory Document[12] (NID), which is submitted each year to the United Nations Framework Convention on Climate Change (UNFCCC), provides details of the methods used to estimate emissions.

Emission inventories will always have some uncertainty. It is not possible to measure directly all the emissions from a country, so inventories are largely based on statistical activity data as well as on emission factors[13], both of which are subject to uncertainty. The UK GHG Inventory assesses uncertainties according to internationally agreed good practice guidance[14], and this uncertainty information helps prioritise efforts to improve the accuracy of inventories in the future and guide decisions on methodological choice. The uncertainty analysis provides us with a high confidence that UK emissions of GHGs have declined since 1990. The uncertainty

[11] Further detail on IPCC guidance is available from: https://www.ipcc-nggip.iges.or.jp
[12] The NID is accessible from the UNFCCC website: https://unfccc.int/ghg-inventories-annex-i-parties/2024 The NID covering methodologies used to estimate 1990-2023 GHG emissions will be published in April 2025. Alternatively, further details on how the UK GHG Inventory is compiled can be accessed from: https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics.
[13] The emissions factor is the emissions per unit of activity. Emission factors are typically derived from measurements of a number of representative sources and the resulting factor applied to all similar sources in the UK.
[14] IPCC guidelines, as adopted by the UNFCCC.

associated with estimates of emissions is small at approximately 2.6% based on 2022 emissions data published in 2024. Furthermore, since 2011, DESNZ has funded the Greenhouse Gas Emissions Monitoring and Verification Programme[15]. The UK is one of only four countries in the world currently reporting the validation of greenhouse gas emissions based on measurements. The contribution of evidence from observations supports our assessment of the robustness of the UK's National Atmospheric Emissions Inventory (NAEI).

To ensure transparency and credibility in carbon budgets reporting, it is important that any changes to GHG reporting – made in accordance with international practice – are clearly stated. Section 16(4) of the Climate Change Act requires that, where adjustments in the official emissions estimates for an earlier year in the same budgetary period are required as a result of changes to international carbon reporting practice, the Annual Statement of Emissions must specify the adjustment required and state the adjusted amount. As 2023 is the first year in the fourth carbon budget, this report does not state adjustments for earlier years in the same budgetary period.

GHG emissions reported in this publication are expressed in terms of carbon dioxide equivalent (CO_2e), recognising the different global warming potentials (GWPs) of each gas. GWPs are set out by the IPCC in Assessment Reports and are updated on a regular basis. Official estimates contained within this Annual Statement of Emissions use 100-year GWPs (without climate-carbon feedback) as set out in the fifth assessment report of the IPCC (AR5), consistent with the agreement reached in November 2021 at COP26 on Paris Agreement transparency framework reporting.

Detailed information on the impact of methodology changes on GHG emissions estimates is published annually with the latest covering the 1990-2023 UK GHG Inventory[16].

International aviation and international shipping

Section16(5) of the Climate Change Act

Emissions from international aviation and international shipping are not included in the UK's emissions as reported under section 16(2) of the Climate Change Act 2008.

In June 2021, the UK government set the Sixth Carbon Budget (covering 2033-37) to include the UK's share of international aviation and shipping emissions, as recommended by the Climate Change Committee. This will be the first time emissions from international aviation and shipping will be included carbon budgets. Until then, international aviation and international shipping emissions are reported under section 16(5) of the Climate Change Act 2008 and appear as a memo item in the UK GHG Inventory.

[15] https://www.metoffice.gov.uk/blog/2023/uk-greenhouse-gas-emission-verification-system
[16] The final 2023 estimates of UK GHG emissions were published on 6 February 2025: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-statistics-1990-to-2023

Emissions from international aviation and international shipping can be estimated from refuelling from bunkers at UK airports and ports, whether by UK or non-UK operators. Table 2 below shows GHG emissions from these sources in the base year, 2022 and 2023.

Table 2 shows GHG emissions from international aviation and international shipping totalled 39.5 million tCO2e in 2023.

Table 2: International aviation and shipping GHG emissions by gas (tCO2e)

Emissions	GHG	Base year	2022	2023	2022 to 2023 change
International aviation	Carbon dioxide (CO2)	15,375,465	28,113,486	32,920,944	4,807,458
	Methane (CH4)	9,292	2,359	2,412	53
	Nitrous oxide (N2O)	129,346	237,486	279,784	42,298
	Total	15,514,103	28,353,331	33,203,140	4,849,809
International shipping	Carbon dioxide (CO2)	8,029,513	6,226,774	6,194,459	-32,316
	Methane (CH4)	3,297	2,251	2,188	-62
	Nitrous oxide (N2O)	100,422	75,683	75,097	-587
	Total	8,133,233	6,304,708	6,271,744	-32,965
International aviation and shipping	Carbon dioxide (CO2)	23,404,978	34,340,260	39,115,403	4,775,142
	Methane (CH4)	12,589	4,610	4,601	-9
	Nitrous oxide (N2O)	229,768	313,169	354,881	41,711
	Total	23,647,335	34,658,039	39,474,884	4,816,844

Part 2 – The net UK carbon account

Section 27 of the Climate Change Act 2008 makes provision for regulations to be made in relation to the crediting to or debiting from the net UK carbon account of specified carbon units. Prior to 2021, when the UK was participating in the EU ETS, the net UK carbon account was adjusted to reflect net trading of emissions allowances. As of 2021, the UK is no longer participating in the EU ETS, and no other adjustments were required for carbon unit trading. As such, the 2023 net UK carbon account reported in this Annual Statement of Emissions is equal to 2023 UK net territorial GHG emissions, pursuant to sections 29(2) and 89 of the Act.

2.1 Total amount of units credited to and debited from the net UK carbon account

Section 16(6) of the Climate Change Act

In respect of 2023, no carbon units were credited to or debited from the net UK carbon account. Emissions are reported on a territorial basis without adjustments for trading, pursuant to Climate Change Act 2008 sections 29(2) and 89.

2.2 Net UK carbon account for the year

Section 16(7) of the Climate Change Act

The net UK carbon account is calculated by taking net UK emissions and adjusting them to account for units debited from and credited to the net UK carbon account. No carbon units were credited to or debited from the net UK carbon account in 2023. The net UK carbon account in 2023 is 384,972,556 tCO2e.

This publication is available from: www.gov.uk/government/publications/annual-statement-of-emissions-for-2023

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