Department for Energy Security & Net Zero

UK greenhouse gas emissions statistics: 2025 planned methodology changes

January 2025

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Introduction

This note sets out and estimates the impact of planned methodology changes to UK greenhouse gas emissions statistics due for publication in 2025 and covers:

- Final UK greenhouse gas emissions statistics for 1990-2023 to be published on 6th February 2025.
- Provisional UK greenhouse gas emissions statistics for 2024 to be published on 27th March 2025.

Figures presented in this note are provisional and do not provide a complete indication of the revisions to the statistics. Importantly, this note only covers methodology changes. The figures do not account for any revisions to the data sources used to estimate the UK's emitting activities, such as to UK energy statistics published in the latest Digest of UK Energy Statistics (DUKES).

Throughout this note, emissions estimates are expressed in million tonnes of carbon dioxide equivalents (MtCO2e), with emissions from each gas weighted based on its global warming potential[1].

[1] The global warming potentials (GWPs) used are from table 8.A.1 (without climate-carbon feedback) of Working Group 1 of the IPCC Fifth Assessment Report: Climate Change 2013

Final UK greenhouse gas emissions statistics: 1990-2023

Background

Final UK greenhouse gas emissions statistics are derived from the UK Greenhouse Gas Inventory, the dataset of greenhouse gas emissions occurring within the borders of the UK that the UK is required to report on under the United Nations Framework Convention on Climate Change (UNFCCC).

Each year, there are methodological improvements to the way that emissions are estimated. Changes are applied back through the time series to 1990, to ensure that the trend in emissions from 1990 to the present is based on a consistent method. Therefore, it is not appropriate to compare different years' inventory submissions. However, the latest inventory represents a single consistent data series going back to 1990, allowing for year-on-year comparisons to be made.

The impacts of each methodology change on the UK 1990 and 2022 greenhouse gas emissions totals are given in Table 1. The combined impact of them on each Territorial Emissions Statistics (TES) sector is shown in Table 2. Impacts are also reported as a percentage of the total UK emissions reported from last year's statistics.

Impact of methodology changes

In total, the method changes scheduled for the 1990-2023 greenhouse gas emissions statistics are estimated to decrease total UK emissions in 1990 by 1.52 $MtCO_2e$ (-0.19%) and increase total UK emissions in 2022 by 1.62 MtCO2e (0.40%).

Table 1 shows the impact of methodological changes made this year on total UK emissions estimates.

Table 1 – Provisional effect of individual changes on UK totals[2,3,4]

Change	Reason for change	Change in emissions (MtCO2e)		Impact on national total from previous inventory (%)	
		1990	2022	1990	2022
Landfill	Review of model assumptions	-1.36	1.49	-0.17%	0.37%
Wastewater	Review of model assumptions	-0.45	0.00	-0.06%	0.00%
Bioenergy	Model and data updates	0.18	-0.13	0.02%	-0.03%
Biodiesel	Review of model assumptions	0.00	~0.00	0.00%	~0.00%
Active deep coal mines	Site-specific measurements	0.00	0.25	0.00%	0.06%
Autogeneration	Model and data updates	0.00	0.00	0.00%	0.00%
Burning oil	Model and data updates	~0.00	0.00	~0.00%	0.00%
Outdoor waste burning	Model and data updates	0.10	0.06	0.01%	0.01%
Domestic combustion	Model and data updates	0.00	0.02	0.00%	0.01%
Agriculture changes	Model and data updates	0.11	0.15	0.01%	0.04%
Land use, land use change and forestry (LULUCF) changes	Model and data updates	-0.10	-0.22	-0.01%	-0.05%
TOTAL[5]		**-1.52**	**1.62**	**-0.19%**	**0.40%**

[2] ~0.00 indicates where a value is non-zero but is less than either 0.005 MtCO2e or 0.005% in magnitude. 0.00 indicates a value that has not changed.
[3] A positive number indicates an increase on last year's emissions estimates; a negative number indicates a decrease.
[4] All figures have been rounded to 2 decimal places.
[5] Totals may not sum due to rounding.

Table 2 summarises the estimated aggregate impact of methodological changes for each sector.

Table 2 – Provisional effect of changes on UK totals by sector[6,7,8]

TES sector	Change in emissions (MtCO2e)		Impact on national total from the previous inventory (%)	
	1990	2022	1990	2022
Domestic transport	0.00	-0.01	0.00%	~0.00%
Electricity supply	~0.00	0.13	~0.00%	0.03%
Fuel supply	0.00	0.25	0.00%	0.06%
Buildings and product uses	1.10	0.35	0.14%	0.09%
Industry	-1.25	-0.59	-0.15%	-0.15%
Agriculture	0.29	0.16	0.04%	0.04%
Waste	-1.56	1.55	-0.19%	0.38%
Land use, land use change and forestry (LULUCF)	-0.10	-0.22	-0.01%	-0.05%
TOTAL[9]	**-1.52**	**1.62**	**-0.19%**	**0.40%**

[6] ~0.00 indicates where a value is non-zero but is less than either 0.005 MtCO2e or 0.005% in magnitude. 0.00 indicates a value that has not changed.
[7] A positive number indicates an increase on last year's emissions estimates; a negative number indicates a decrease.
[8] All figures have been rounded to 2 decimal places.
[9] Totals may not sum due to rounding.

Summary of methodology changes

Details of the scheduled methodology changes are given below. Further information on the updated methodologies will be available in the UK National Inventory Document (NID) when it is submitted to the UNFCCC in April 2025[10].

Landfill

There has been an update to the delay between waste deposition and the start of methane (CH4) generation assumed in the landfill model, in response to a review indicating an inaccuracy in the previously assumed delay.

Organic material in solid waste degrades over time, with CH4 emissions from anaerobic decomposition occurring over multiple years after waste is deposited at a solid waste disposal site. A review of the waste sector identified that the previously assumed delay to the start of the waste degradation of zero was inconsistent with the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories[11]. Therefore, the landfill model has been updated to incorporate the IPCC default delay time of 6 months.

Whilst there is no impact on total landfill CH4 emissions that are estimated to have occurred, the implementation of a 6-month delay has a significant impact on the distribution of emissions between years.

Wastewater

Sewage sludge disposed to sea is now assumed to be settled, and therefore have zero emissions when disposed to sea.

Previously, the IPCC default emission factor for untreated sewage disposal had been used to calculate CH4 emissions from the release of sewage sludge disposal to sea. However, the IPCC default factor is deemed to be more representative of disposal to warm, organically loaded and stagnant water, and therefore overestimates emissions from releases of sewage sludge to the colder, clear, and free flowing water more typical for the UK. Sea disposal of sewage sludge was phased out by 1998. Therefore, this change leads to a reduction in emissions from wastewater in the earlier portion of the timeseries.

Bioenergy

Individual bioenergy models have been consolidated into a new aggregate bioenergy model. Importantly, the new model preserves a higher level of granularity of calculated

[10] The UK NID covering 1990-2023 emissions will be submitted to the UNFCCC by 15th April 2025. Previous submissions can be found here: https://unfccc.int/reports.

[11] 2006 IPCC Guidelines for National Greenhouse Gas Inventories: https://www.ipcc-nggip.iges.or.jp/public/2006gl/.

emissions estimates. Improved granularity allows for more detailed breakdowns of emissions estimates from bioenergy use, as well as better allocation of emissions across sectors. Key improvements include:

- Additional breakdown of emissions from the full range of biofuels used in road transport.
- Disaggregation of industrial wood use across sectors.
- Disaggregation of municipal solid waste (MSW) incineration emissions to include separate estimates for fossil-based residual wastes and biogenic wastes.
- Categorisation of biomass into plant or animal biomass.

In addition, consolidation of models has removed some minor instances of double counting of emissions.

Biodiesel

Motor and heating fuels are liable to fuel duty. Historically, gas oil (diesel) intended for use in road vehicles, otherwise known as ‘white diesel’, has been subject to a higher tax rate than ‘red diesel’ intended for use in settings outside of road transport.

However, from April 2022, the entitlement to use rebated red diesel was removed for most sectors. Correspondingly, the previous assumption that biodiesel, subject to the same tax rate as white diesel, was almost exclusively consumed by road users no longer applies. Instead, this biodiesel use is now distributed across users of gas oil on a pro-rata basis. This change leads to minor reallocations of biodiesel use emissions from road transport to the industry and agriculture sectors from 2022.

Active deep coal mines

Estimates of CH4 emissions from active coal mines have been updated to incorporate site-specific data for the Aberpergwn colliery, the largest UK coal mine currently in operation. Previous estimates derived by extrapolating production data from DUKES underestimated emissions as anthracite extracted at the Aberpergwn colliery is primarily sold for non-energy uses. Therefore, site-specific measurements are deemed to be more representative than the DUKES data focused on UK production for the energy sector. Overall, incorporation of this more accurate data results in a small increase in CH4 emissions from the fuel supply sector.

Autogeneration

The models used to estimate emissions from organisations generating their own electricity (autogeneration) have been updated to employ more granular data on oil use. Autogeneration from the use of fuel oil and gas oil has been separated from other industrial combustion for the first time.

This change has neither an impact on the overall estimate of UK territorial greenhouse gas emissions, nor the sectoral allocation of emissions. Instead, the improved method allows for a more detailed and transparent breakdown of industrial oil use emissions that is consistent with breakdowns currently provided for coal and natural gas use.

Burning oil

Burning oil use from 1990 to 1997 is now distributed across sectors through use of the average sectoral allocations from DUKES from 2016 to 2019. Previously, timeseries data for burning oil use contained large steps between 1997 and 1998 due to lack of sectoral consumption data in DUKES prior to 1998. Average sectoral allocations from 2016 to 2019 are employed in the absence of time-series consistent data for previous years.

This change results in minor reallocations of burning oil use emissions from the industry sector to the buildings and product uses and agriculture sectors.

Outdoor waste burning

The model used to estimate emissions from waste burning has been updated to incorporate data from Defra 2019 and 2022 Domestic Burning Surveys, and to enable a more detailed breakdown of small-scale waste burning emissions by waste type. In addition, minor issues with some nitrous oxide (N2O) emissions factors and the dry matter content parameter have been corrected.

Domestic combustion

The model used to estimate emissions from domestic solid fuel combustion has been updated to include data from Defra 2019 and 2022 Domestic Burning Surveys. This allows for the inclusion of use of coffee logs for the first time. In addition, new DUKES data has been utilised to improve estimates of domestic wood use. Overall, these changes have minimal impacts on domestic combustion emissions.

Agriculture

There have been several methodological updates to estimates of emissions from the agriculture sector. These include:

- An update to the estimation of N2O emissions from storage of slurry from dairy cows to include an emissions factor for natural crust cover for the first time. The emission factor for natural crust cover employed is the default factor from the 2019 Refinement to the 2006 IPCC Guidelines for Greenhouse Gas Inventories and is applied to dairy cow slurry at storage only[12]. It has been assumed that 80% of non-

[12] 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories: https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.

covered tanks form a natural crust. As uptake of covers increases, the percentage of crusted stores will be adjusted downwards. Implementation of an emissions factor for natural crust cover has resulted in small increase in N2O emissions in the agriculture sector across the entire timeseries.

- Updated modelling assumptions for estimating emissions from landspreading of organic manure to account for regulatory changes. In Wales, a new policy was introduced in 2021 whereby application of organic manure (slurry, digestate, and poultry manure) to bare soil or stubble must be incorporated within 24 hours, unless low emissions slurry spreading equipment (LESSE) has been used[13]. In Scotland, a new policy was introduced in 2023 whereby all liquid digestate as well as slurry applied by contractors or on large cattle and pig farms should be applied using LESSE[14]. In addition, assumptions around uptake of LESSE in Northern Ireland have been revised on receipt of additional activity data.

- Updated modelling assumptions for estimating emissions from slurry storage in above ground tanks to account for regulatory changes in Northern Ireland requiring all new slurry stores to be covered[15]. Correspondingly, assumptions around uptake of covers as a mitigation measure have been revised.

Land use, land use change and forestry

There have been several methodological updates to estimates of emissions from the LULUCF sector. These include:

- Updates to peatland restoration areas for Scotland and Northern Ireland. For Scotland, restoration area changes occur from 2013-2022 and are based on updated data from Peatland Action, whereas for Northern Ireland, changes occur from 2020-2023 and are based on data from the Northern Ireland Executive Department of Agriculture, Environment and Rural Affairs (DAERA). These changes impact the distribution of rewetting activities across the specified timeseries.

- Several updates to the forest carbon accounting model, including improved early growth estimates, incorporation of carbon from branches on dead trees into the soil, increases in the decay rate of dead branches from 4% to 14% based on a recent review performed by Forest Research, as well as updates to the calculation of the anaerobic conditions soil water availability modifier.

[13] The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021: https://www.gov.wales/water-resources-control-agricultural-pollution-wales-regulations-2021-guidance-farmers-and-land.
[14] The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021: https://www.legislation.gov.uk/ssi/2021/412/body/made#regulation-3-4-j.
[15] The Nutrient Action Programme Regulations (Northern Ireland) 2019: https://www.daera-ni.gov.uk/articles/silage-slurry-and-agricultural-fuel-oil-ssafo-storage.

- Updates to deforestation areas. For Scotland, estimates of areas of rewetted forest for 2013-2023 have been updated based on data from Peatland Action. For Northern Ireland, estimates of areas of rewetted forest for 2020-2023 have been updated based on data from DAERA. This is the first time that forest to wetland data has been available for Northern Ireland. For England, 2022 deforestation areas are derived from the 2023-2024 Forestry Commission Key Performance Indicators[16]. The 2022 deforestation areas are carried forwards for 2023.

- Updates to assumptions for harvested wood products based on additional information from Forest Research. Overall, estimates of sawmill input have been improved, leading to minor changes across the entire timeseries.

- Minor updates to estimates of harvest intensity for private forest in Northern Ireland. This leads to minor changes in estimates for forest land carbon stock change and harvested wood products.

- Updates to soil carbon stock change areas to ensure consistency with the areas used to calculate biomass losses and burning emissions.

- A minor update to include Welsh wildfire data for 2022.

- A minor update to include new bioenergy crop areas for England for 2021 and 2022. Previously, the 2020 crop areas were held constant for these years.

- An update to report indirect N2O emissions within their corresponding direct emissions categories. Previously, these emissions were reported under a separate category within the LULUCF sector.

- An update to disaggregate rewetted fen areas into separate grassland and wetland areas to ensure that emissions are allocated to the correct categories within the LULUCF sector after 20 years.

- Additional minor corrections to area estimates for Bermuda and the Cayman Islands, and corrections to estimates for the Cayman Islands to ensure correct implementation of the carbon fraction of land to settlement biomass losses. As these changes are exclusive to Overseas Territories, their impacts are excluded from the LULUCF totals in Table 1 and Table 2 which only show the impacts of changes on UK totals.

[16] Forestry Commission Key Performance Indicators: https://www.gov.uk/government/collections/forestry-commission-corporate-plan-performance-indicators.

Provisional UK greenhouse gas emissions statistics 2024

Background

Final UK greenhouse gas emissions statistics are published 13 months after the end of the year they refer to. However, timelier provisional estimates of overall and sectoral UK greenhouse gas emissions are published 3 months after the end of the year they refer to.

This year, methodological improvements are planned for the UK provisional emissions estimates. Currently, provisional estimates of energy-related carbon dioxide (CO2) emissions, accounting for around 75% of total UK greenhouse gas emissions, are produced based on provisional energy statistics published in the quarterly Energy Trends publications[17]. Meanwhile, residual CO2 emissions (around 4% of total emissions) are assumed to stay constant, whereas all non-CO2 greenhouse emissions (around 20% of total emissions) are estimated using growth rates derived from the latest Energy and Emissions Projections publication[18]. Full details of the current approach can be found in the methodology summary that accompany the 2023 provisional UK greenhouse gas emissions statistics[19].

Changes scheduled for the 2024 provisional UK greenhouse gas emissions statistics focus on better use of the available Energy Trends data to ensure that the best available proxies are employed in emissions calculations. Another notable change includes use of Energy Trends data for estimating energy-related non-CO2 greenhouse gas emissions for the first time.

The impacts of each methodology change on the UK 2023 provisional greenhouse gas emissions totals are given in Table 3. The combined impact of them on each TES sector is shown in Table 4. Impacts are also reported as a percentage of the provisional estimated UK total reported for 2023.

Impact of methodology changes

In total, the method changes scheduled for the 2024 provisional UK greenhouse gas emissions statistics are estimated to increase UK emissions in 2023 by 1.29 MtCO2e.

[17] Energy Trends: https://www.gov.uk/government/collections/energy-trends
[18] Energy and emissions projections: https://www.gov.uk/government/collections/energy-and-emissions-projections
[19] 2023 provisional UK greenhouse gas emissions statistics: https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2023

Table 3 shows the impact of the planned methodological changes for this year's provisional UK emissions estimates if applied to the 2023 provisional estimates.

Table 3 – Estimated effect of individual changes on provisional UK emissions estimates[20,21,22]

TES Sector	Reason for change	Change in emissions (MtCO2e)	Impact on national total from previous provisional estimate (%)
		2023	2023
Industrial manufactured fuel use	Data updates	2.01	0.52%
Road and waterborne fuel use	Data updates	-0.17	0.04%
Road gas use	Data updates	-0.10	-0.02%
Non-domestic oil use	Model and data updates	0.01	~0.00%
Agriculture coal and gas use	Data updates	~0.00	~0.00%
Energy-related non-CO2	Model and data updates	-0.47	-0.12%
TOTAL[23]		**1.29**	**0.34%**

[20] ~0.00 indicates where a value is non-zero but is less than either 0.005 MtCO2e or 0.005% in magnitude. 0.00 indicates a value that has not changed.
[21] A positive number indicates an increase on last year's emissions estimates; a negative number indicates a decrease.
[22] All figures have been rounded to 2 decimal places.
[23] Totals may not sum due to rounding.

Table 4 summarises the estimated aggregate impact of methodological changes for each sector.

Table 4 – Estimated effect of changes on provisional UK emissions estimates by sector[24,25,26]

TES Sector	Change in emissions (MtCO2e)	Impact on national total from previous provisional estimate (%)
	2023	2023
Domestic transport	-0.27	-0.07%
Electricity supply	-0.04	-0.01%
Fuel supply	-0.16	-0.04%
Buildings and product uses	-0.09	-0.02%
Industry	1.71	0.45%
Agriculture	0.02	0.01%
Waste	0.01	~0.00%
Land use, land use change and forestry (LULUCF)	0.11	0.03%
TOTAL[27]	**1.29**	**0.34%**

[24] ~0.00 indicates where a value is non-zero but is less than either 0.005 MtCO2e or 0.005% in magnitude. 0.00 indicates a value that has not changed.
[25] A positive number indicates an increase on last year's emissions estimates; a negative number indicates a decrease.
[26] All figures have been rounded to 2 decimal places.
[27] Totals may not sum due to rounding.

Summary of methodology changes

Details of the scheduled methodology changes are given below. Further information on the updated methodologies will be available in the methodology summary published alongside the statistics.

Industrial manufactured fuel use

Estimates of emissions from industrial and energy industry use of blast furnace gas, coke oven gas, and other manufactured solid fuels have been updated to use more appropriate provisional energy balance data. Previously, Energy Trends data on manufactured solid fuel use was applied in estimations of emissions from use of blast furnace gas. More appropriate proxy Energy Trends data for blast furnace gas has now been identified and is applied to estimate the corresponding blast furnace gas use emissions. In addition, more appropriate Energy Trends data for coke oven gas use has been introduced into models for estimating emissions from coke oven gas use.

Rail and waterborne fuel use

Rail and waterborne oil and coal use emissions are now estimated through use of separate trends in the Energy Trends data.

Previously, Energy Trends rail and waterborne oil use data were aggregated, and the resultant trend applied to estimate all rail and waterborne emissions, as well as residual emissions in the domestic transport sector, such as those from stationary combustion at railways and lubricant use. However, estimation of emissions from rail coal use, rail oil use, and waterborne oil use separately, through use of the corresponding energy balance data, is deemed to provide more reliable emissions estimates when compared to the previous use of an aggregate trend. Meanwhile, residual emissions from the domestic transport sector are now held constant in the absence of appropriate Energy Trends proxy data.

Road gas use

Estimates of emissions from road use of natural gas and liquid petroleum gas have been updated to use more appropriate provisional energy balance data. Previously, Energy Trends data for liquid petroleum gas use on roads was erroneously applied in estimations of emissions road use of natural gas.

Non-domestic oil use

Non-domestic oil use emissions are now estimated through use of the aggregate trend in non-domestic oil use.

Previously, estimates of oil use emissions were calculated at a sectoral level through use of sectoral oil consumption data in Energy Trends. However, reallocations of DUKES sectoral oil consumption data in UK Greenhouse Gas Inventory modelling mean that the sectoral consumption trends are unreliable for estimating oil use emissions for most sectors. Instead, the aggregate trend in non-domestic oil use is deemed to provide a more reliable estimate of total emissions from oil use and is now used in place of individual estimates for commercial, public sector, and power station use of oil.

In addition, the aggregate non-domestic oil use data also includes agricultural use of oil. Correspondingly, the non-domestic oil use trend is also employed to estimate emissions from oil use in the agriculture sector for the first time. Prior to this change, emissions from oil use in the agriculture sector were assumed to be constant in provisional estimates.

Agriculture coal and gas use

To align with use of energy data for estimating oil use emissions in the agriculture sector for the first time, provisional estimates of emissions from coal and gas use in the agricultural sector have also been updated to be based on data from Energy Trends. Previously, these emissions were assumed to be constant in provisional estimates.

However, it is important to note that UK agricultural coal use has been zero since 2013. Therefore, this change leads to minor changes in natural gas use emissions estimates only.

Energy-related non-CO2

Models that employ Energy Trends data to calculate energy-related CO2 emissions, have been updated to also include the corresponding non-CO2 emissions. This is the first time that observed energy data has been used for non-CO2 emissions in the provisional UK emissions estimates.

Previously, all provisional estimates of non-CO2 emissions were derived through use of year-on-year growth rates in emissions published in the Energy and Emissions Projections. Now, use of projections is only used for non-energy related non-CO2, in absence of appropriate observed data at the time of publication.

The new approach for energy-related non-CO2 emissions incorporates all other methodology changes to the provisional statistics listed in this report.

This publication is available from: www.gov.uk/government/publications/planned-methodology-changes-for-uk-greenhouse-gas-emissions

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